



THE  
SUGAR CANE:

*A Monthly Magazine,*

DEVOTED TO THE INTERESTS OF THE SUGAR CANE  
INDUSTRY.

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VOLUME X.

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 The writers alone are responsible for their statements.

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## INTRODUCTORY.

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The *Sugar Cane* now enters upon the tenth year of its existence, and we have sincere pleasure in assuring our readers that its growth has been progressive, and that its circulation at the present time is larger than at any previous period.

Our thanks for this success are not only due to those of our subscribers who have shown their interest in the Magazine, and their sense of the need of such a publication, by recommending it to the notice of their friends, but to the contributors of the many valuable articles which have appeared from time to time in its pages; and we have good grounds for hoping that the services of both may be counted on in the future.

One of the objects sought in the establishment of the *Sugar Cane* was to provide an arena for the discussion of all subjects connected with the Industry. There is room for further use of the facilities thus afforded, and we cordially invite such of our friends as have had practical experience in the various departments to avail themselves freely of its use, which cannot but result in reciprocal benefits.

The Magazine being chiefly devoted to the Sugar Industry, and having a wide and increasing circulation among the different classes connected therewith, whether Planters, Merchants, Brokers, or those who minister to their wants, it not only supplies the kind of information which each requires, but affords a valuable means



of intercommunication on matters of business, and peculiar advantages for the advertisement of sugar machinery, agricultural implements, artificially prepared manures, bone char, and, in fine, whatever else is used in the cultivation of the raw material—cane or beet—and its subsequent manufacture and conversion.

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### THE SUGAR QUESTION IN BELGIUM.

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A short discussion on the sugar question, incidental to a debate on the Budget, took place in the Belgian Chambers on the 11th and 12th of December. The following is a condensed report:—

M. MEEUS reminded the Chamber that in the course of the preceding Session he had had occasion to question the Finance Minister, and had insisted that the Government should exercise the right given it by the law of 1873, and levy a surtax on foreign sugars, both refined and raw. He had based his demand on several considerations, more especially on the fact that France, directly after the expiration of the Convention of 1864, had re-established the surtax existing previous to the Convention. He had also pointed out the present state of the sugar industry, and more especially of the refining industry. The Minister, he was sure, would not deny that the greater part of the grand refineries of the country had recently been closed, and that the importation of foreign refined sugar was increasing rapidly.

M. MALOU (Minister of Finance) said: The Chamber is aware that the Convention of 1875, which it had accepted by a large majority, had been rejected by Holland. At that time the French Government, in spite of all our efforts—and I prolonged them as far as it was possible—refused to continue the deduction of the surtax in respect of Belgian and Dutch sugars. Negotiations, as the honorable member is aware, were resumed at the beginning of the year by the holding of a Conference, when the study and examination of the question was prolonged for nearly six weeks and resulted in a new arrangement, in which the essential basis of the Convention of

1875 was maintained, with the exception of some modification of the details. This arrangement has not been agreed to by the Dutch Government. Modifications of the draft Convention were communicated to us almost immediately—I think in the month of March or April,—and these communications have been the subject of negotiations which still continue, which are not yet closed, and of which I am unable precisely to indicate the limit. The Chamber will understand that the Ministerial crisis in Holland, which has continued for some time, has already been a considerable obstacle, without alluding to other political circumstances in another country which have rendered a thorough discussion of the sugar question sufficiently difficult. The honorable member has spoken of the refineries, and appears to consider that the acts of the Belgian Government or Legislature have produced the decadence of the refining industry in Belgium. This, however, is absolutely contrary to the facts. The refining industry suffers and declines because the Convention of 1875 has not been ratified, and an end has not yet been put to the formidable bounties enjoyed by the French refiners, to the detriment of the French Treasury and of the manufacturers of other countries. If the Convention of 1875 had not, unfortunately, been rejected, our refining industry in Belgium would have maintained itself in a relatively prosperous state. It is deplorable that our refining industry should decline; but it is in no way the result of any act of the Legislature or Government. I indicate the essential cause of it, recognised by every one. So long as, under present conditions of transport and production, a foreign industry receives fifteen or sixteen millions of bounties annually, it is quite evident that competition is almost impossible. The honorable member asks us to re-establish a surtax. Gentlemen, this would be, in my opinion, an excessively grave act, completely inconsistent with the commercial policy of the Belgian Government. Certainly, if the negotiations now in progress do not succeed within a certain time, the Government and the Chambers will have to consider the matter. But I do not think that the measure we are advised to take would be useful under present circumstances. Were it taken at once it would be no remedy to the facts I have pointed out; it would not prevent the magnitude of the bounties enjoyed by the French

refiners from injuring and destroying our refineries ; while those of Holland would go in their turn.

\* \* \* \* \*

M. PUISSANT : The Minister considers that the time has not come for re-establishing a surtax, as the Government has a right to do. He, nevertheless, admits that if the present negotiations do not succeed within a certain time, the Government and the Chambers will have to consider the matter. I think that the sugar industry would desire to know the intentions of the Government more precisely. Already, in 1874, the Minister recognised the necessity, in default of a Convention, of immediately submitting propositions to the Chambers for the protection of our interests. In the last session he again expressed himself in the same sense. It is to be feared, under present circumstances, that it will be long before a Convention is obtained, and that, in any case, it is now almost certain not to come into force during the coming year. I therefore ask whether the time has not come for considering what should be done. Would it be best to revert to the situation in which the sugar industry was before 1864, when refined sugar had to pay an import duty of 4fr. 50c., and raw sugars 1fr. 20c. per 100 kilos. ? I think so ; but, without committing myself definitely on the question, I maintain that those duties were in no way protective duties. In face of the power of the French refinery, which profits by enormous bounties on the exportation of refined sugars, and which manipulates the sugar market as it likes ; in presence, also, of the bounties which the raw sugars from Germany and Austria enjoy, the import duties of which I speak cannot be considered more than compensating duties. The sugar industry is passing through a new crisis. The fall in sugar is not due to excessive production. I think, then, that the Government might usefully examine, without delay, what it would be best to do, in order to protect as much as possible the interests of our manufacturers, until a Convention can be concluded between the Powers interested.

M. MALOU, Minister of Finance : The Honourable M. Puissant has returned to the question of sugar. I can in no way add to what I said yesterday in reply to M. Meeus. Only, I do not think, like the honorable member, that we should despair of obtaining a new Con-

vention before the next beetroot sugar campaign. From the actual state of the negociations, I hope that we shall succeed. I observe with great pleasure that those who opposed the Convention of 1875 appear now greatly to regret that it has not been applied by the other countries. It is a progress in the discussion, brought about by experience, with which I am much pleased. I know not whether the honorable M. Puissant voted against the Convention, but I know that I replied at great length to the observations he made against the Convention. He is converted. I make no reproach. I am glad, for the sake of the sugar industry and country. I persist in thinking that it would not be right at this moment, while the negociations continue and promise to be successful, to strike at foreign industries. And, in fact, even supposing that our commercial system and treaties permit, it is evident that duties thus imposed provoke reprisals. To whom would these reprisals profit? Neither to the one party nor the other. It is like war, where there must be a conqueror; but where conqueror and conquered equally suffer. I think, therefore, that it is only in the last extremity, and in presence of an imperious necessity, that one ought to enter into such a course of reprisals. Moreover, gentlemen, on what would they be founded? There is no new circumstance! When the Convention of 1864 was concluded, a reduction of the duty on importations from other sources into France was made for sugar coming from the contracting countries. The Convention not having been renewed in 1875, this difference was suppressed, and the duty has been re-established. But there is no new fact to-day which would justify the imposition of exceptional duties on certain countries on the importation of their sugars into Belgium. And observe, gentlemen, that we sell sugar to an enormous extent in those countries, and that it is to our interest, in the present state of transition, not to disturb existing relations.

M. MEÛS: The honourable Minister has spoken of reprisals. We do not demand reprisals. We ask, purely and simply, that the Government should restore things to the state in which they were before the Convention of 1864 was put in force. I demand that the Belgian Government should do what the French Government has done. On the morrow of the day when the Convention of 1864 ceased to exist, they simply put matters back to the state in which

they were anterior to it; that is, the three Powers which had been parties to the Convention were placed, as regards the importation of sugar, absolutely on the same footing as other Powers which had not taken part in the Convention. Now, in Belgium, before 1864, we had a surtax on refined as on raw sugar, and I simply ask that we should revert to that anterior legislation. I may even express here all the astonishment I feel that the Government did not immediately take this course. It was the only course there was to take, and, for my part, I am convinced that if it had been taken we should have negociated more easily than we have at present done. The observation which has been made, that no new fact has arisen, therefore falls to the ground. A new circumstance has, moreover, occurred. Already, under the *régime* of the Convention of 1864, the refining industry had suffered considerably in Belgium. The sufferings of this industry do not, in fact, date only from 1874,—the date of the expiration of that Convention; they date from an earlier period. In 1864 there were bounties in France, but those bounties became much more considerable after the increase of the duties in 1871. It is this increase of the duties in France which is the true cause of the ruin of the refining industry in Belgium. This is the new fact of which the Government take no account. To this situation there is a remedy: it is to revert to the legislation existing before 1864. I believe that the Government can perfectly well do so without adopting reprisals against any country, and without receiving any observation on the part of any Power.

It is evident, from the tone of this discussion, that the question is not likely to be allowed to rest so far as Belgium is concerned. The return of M. Teisserenc de Bort to the French Ministry of Commerce is also favourable to a resumption of the negociations, and he must necessarily take some action on the very important decision of his predecessor.\* The new Dutch Ministry will probably be able to turn their attention to the subject after the Christmas vacation, and therefore there is every prospect, provided no further political complications arise, that good progress will very shortly be made.

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\* Letter of M. de Meaux to the President of the Fabricants' Committee, see *Sugar Cane*, page 558.

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### THE AMERICAN REFINERS AND THE DRAWBACK.

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The refiners in the United States have, as was to be expected, raised a great cry against the recent decision of the Secretary of the Treasury, Mr. Sherman, respecting the drawback on the exportation of refined sugar. As far as we can ascertain, they have not, however, put forward any fresh arguments against the reduction of the drawback, which has now become an accomplished fact. All that they have advanced on their side of the question has, we believe, been fully answered, from time to time, in these columns. We shall not, therefore, enter into any further controversy with regard to the agitation now going on. There is good reason to believe that the Treasury at Washington is now fully informed as to the true state of the case, and is in possession of calculations based on all the results of refining, furnished by the American refiners themselves, which prove that even the amended drawback leaves a considerable margin in favour of the refiner, without taking any account of possible and existing practices as to falsification of colour.

It appears that a representative of the refiners' interests has been occupied for some time at Washington in pressing their claims before the authorities, and endeavouring to show that the new rates of drawback are less than what they are entitled to by law. The refiners complain that no proof was offered at the hearing of the Commissions, and that they were never invited to come forward and state their case. We believe that this is not the fact; that all the refiners were invited to and did furnish the results of their working; and that a full analysis of the figures so furnished, coupled with those given at the inquiry in 1875, resulted in proving conclusively that, apart from all question of false colouring, the drawback which would correctly return the duty paid on raw sugars of natural colour is \$3.06 per 100lbs. of hard sugar exported. The new drawback of \$3.18 dollars per 100lbs., therefore, leaves a margin in favour of the refiner of 16 cents. The refiners repeat their old argument about the quantity of soft sugar which they turn out, which has already been sufficiently refuted,

and is now finally disposed of by the fact above stated. They go on to complain that the new drawback will have the effect of stopping the export trade in hard sugar. This, however, is no proof of its being insufficient. It is, in fact, perfectly manifest that the large quantities shipped during the last two years to this country could only have come here under an artificial system of excessive bounty. It is impossible that, under natural conditions, raw sugar could be sent from the East and West Indies, France, Germany, or Austria, to be refined in New York, Boston, and Baltimore, and then despatched across the Atlantic to compete with British refined, and even with the bounty-fed products of the Continent. They further urge, as they have done on former occasions, that they make hard sugar only out of high-class raws. This, again, has been refuted in the *Sugar Cane* in more ways than one, and is now disposed of by the fact that the importation of high-class raw sugar into the United States is entirely disappearing.

A petition has been addressed to members of Congress, but has, we gather from the newspapers, received the signatures of only five firms. The general feeling appears to be against the pretensions of the refiners. They can, as we have pointed out, be adequately disposed of without taking any account of the frauds which have recently been perpetrated on the Treasury by the introduction of unnaturally coloured sugar, by which means sugars of high quality are introduced at a low duty by reason of their being below the colour standard. It is this artifice, however, which has impressed the public mind, and which is now brought forward as the principal reason for maintaining that the claims of the refiners are inadmissible. Thus, the *New York Grocer*, of December 8th, writes as follows:—

“ Our readers will remember that we published a short while ago the full reports of all the committees appointed by the Secretary to investigate this subject, and also his subsequent order reducing the rate of drawback 42c. per 100 lbs. Certain refiners here have objected all the way through the controversy to the reduction on the ground that the former rate was right and just and no more than they were entitled to in equity. But in stating their

grievances to Congress and to the public they fall short of the full consideration of the subject, in that they fail to state that it depends entirely upon a previous determination of the question of duty paid on the sugars whether the drawback is right at the previous or at the present rate. If sugars grading from Nos. 10 to 12 Dutch Standard and polarizing 95 per cent., on which the average duty is 2 1-8c. per pound, are used, then the previous rate would not be excessive; but if these same sugars by manipulation in their manufacture, by infusing molasses into them and thus making them darker coloured, while they polarize as high a percentage of sugar as before, can be brought into this port so as to be classified as only No. 7, or between Nos. 7 and 10 Dutch Standard, thereby having to pay only 1 3-4c. or 2c. a pound duty, then on this basis the previous rate of drawback was excessive and the present rate about right. The trouble is that some importers found out this method of debasing the colours of sugars a few years ago and have since been quietly but most industriously working the find to their own immense gain and a loss to the Government. It used to be that not more than 25 per cent. of all the sugars imported were under No. 10 Dutch Standard. The reports to which we alluded above developed the astonishing fact that last year no less than 60 per cent. of our imported sugars were not above this grade. Leaving out of consideration the fact that there has been within a few years a large increase in the importation of regularly-made low grade East India and China sugars, it has been further found that this change to a great extent has been brought about by deepening the colour of high grade centrifugal sugars in the process of manufacture simply by infusing molasses into them. Of course, analysis fails to show any artificial or foreign colouring matter. There is nothing but the sugar coloured by the molasses. Of course, further, it was the most natural thing in the world to expect that colour being the test for duty the fact would be taken advantage of. For this the Government can only blame itself. It is more the outcome of defective legislation than of official delinquency, or personal dishonesty. The Government having learned all these things set itself to rectify the mistake, and reduced the drawback and issued stringent rules regarding the introduction of these low coloured bu



high grade sugars. *Hinc illæ lachrymæ* among those refiners that had been so industriously working this *bonanza*. We do not see, however, that the Secretary can hold the position he has taken in seizing these sugars. The law is at fault in grading the duty according to colour, and we cannot understand how he is to prevent the importation of sugars thus coloured or to seize them here."

The writer concludes by suggesting that there should be two duties, one for sugars up to No. 13 Dutch Standard, and another for all sugars above that limit. We fear that this would not remedy the evil, for the refiners would soon succeed in getting sugar of very high strength to pass as below No. 13, and thus secure a continuance of the excessive drawback.

The falsification of colour is not the only abuse which has recently exercised the minds of the Washington officials in connection with this subject. There has also been considerable trouble in connection with the weighing and sampling of raw sugars on entering the refineries. This has called forth an important Treasury circular, in which very strict rules are laid down for the collectors and other officers of the Customs. On this, the *New York Grocer* makes the following remarks:—

"The new regulations, elsewhere published, for sampling and weighing imported sugars, issued by the Secretary of the Treasury, it is thought will have the effect of doing away with some of the most glaring abuses which have heretofore in many instances characterised the methods pursued. More care is to be exercised in taking samples, which are to be publicly exposed in the Custom House for one week, properly labelled and designated, and the sugar itself is not to be taken off the dock until after the return of the weigher and appraiser has been made to the collector, and then only on the collector's written order. No more rushing of sugars into the pans before the samples have reached the appraiser's office. We are in hopes, however, that the proposed tariff revision may make a clean sweep of the present cumbersome and necessarily imperfect system of sugar duties, and give us instead a plain, simple, and sensible method. We do not feel entirely satisfied with any of the systems for collecting duties as applied to sugar, but, taking the interest of the entire country into account, it is

probable that a uniform specific duty would prove most satisfactory. Outside of the refining interest there would hardly be an objection to it. So far as the wholesale or retail merchants are concerned, it would not affect them. The Louisiana sugar interest would be properly protected. The consumer would know no difference, except in the greater variety of high grade imported sugars offered. The collection of the revenue would be immensely simplified. The same principle has always been applied to coffee, tea, spices, etc., and has been found to work well. No effort has ever been made to levy a duty on tea according to quality or description, and yet it would be far more feasible than it is at present on sugar. The distinctions in the grades of coffee are much more readily made than are those of sugar. The various qualities of spices are much more apparent than those developed by the Dutch Standard of colours. Granting that such a duty was levied, the immediate effect would be to cause the importation of the highest grades of sugar, thus, of course, coming in direct conflict with the refiners. But the question naturally arises, shall a much needed reform that is intended to benefit the entire country be given up because it will damage the refiners?"

The whole question has at last become sufficiently important to find its way into the report of the Secretary of the Treasury presented with the President's message to Congress. The President, it is understood, himself endorses the views of the Secretary, which are also said to be fully in accord with the best judgment of the principal merchants in New York. The following is the passage in the report to which we refer:—

"Embarrassment has occurred during the past year in the collection of duties on sugar, under Schedule G, Title 33, of the Revised Statutes. These duties are assessed by the Dutch Standard, according to colour; and it has been alleged that sugars have been artificially coloured in the country of export, to secure their passage at the Custom House at a less rate of duty than would be charged according to the colour acquired in the ordinary process of manufacture. While the truth of such allegation has not been established in any positive manner, notwithstanding the thorough examination which has been made by the officers of this

department, it has been ascertained that the suspected sugars, which pay the lowest rate of duty at the Custom House, were of a higher intrinsic grade in many cases than those paying higher rates of duty. Statistics show that, from some cause, a marked increase has occurred in the importation of sugar subject to the lowest rate of duty, and a corresponding decrease in the importation of unrefined sugars paying the higher rates. This is doubtless due in part to the Act of March 3rd, 1875 (Stat. at Large, vol. 18, page 339), which imposed an additional duty of 25 per cent. of the duties prescribed in Schedule G, and thus increased the discrimination in favour of the lower grade of sugar. The Dutch Standard is an unsatisfactory basis for the assessment of duty, founded as it is on colour alone, which bears no definite relation to the value of the sugar. If, however, the Dutch Standard is to be retained, it is recommended that the grades be reduced in number, so that there shall be but three rates of duty, one for sugars not above No. 13, one for sugars above 13 and not above 20, and another for all sugars above 20, including all refined sugars. Based upon the quantities of the various grades imported during the past two years, the following rates would yield about the same amount of revenue as was collected during that time : Sugars not above No. 13, per pound, 2 38-100; above No. 13 and not above 20, 3 45-100; above 20, and all refined sugars, 5 cents. This is inclusive of the 25 per cent. additional duty imposed by the Act of March 3rd, 1875."

We regret that Mr. Sherman should have taken up the idea of decreasing the number of classes as a way out of the difficulty. It is well known to all who have had to deal with the question in this country for the last fifteen years that such a change would only aggravate the evil. The larger the range of each class the larger must be the gap between the duty on each class, and the greater, therefore, will be the opportunity of obtaining sugar insufficiently assessed with duty, by selecting the richest quality in each class. Thus the excess of drawback on export would not only be maintained but increased. Assessment of the actual sugar contained in the raw material, or levying the duty on the refined sugar instead of on the raw, appear to us the only ways out of the difficulty.

### COLOURED SUGAR FOR AMERICA.

The following paragraph appears in the *Montreal Gazette*, of the 7th December :—

“ The Collector at New York yesterday seized a cargo of sugar valued at \$60,000 on the charge that it had been coloured.”

### THE RUSSIAN CROP.

We have been favoured with the following translation of private correspondence from Russia :—

“ According to Russian Official Returns the crops of sugar in Russia and Russian Poland amounted in

“ 1873-74 to 6,257,773 pud, or about 102,375 tons

“ 1874-75 „ 5,083,544 „ „ 83,200 „

“ but in order to arrive at the actual production, these figures should, for reasons well known, be multiplied by 2. We thus obtain

“ for 1873-74 a production of about 204,750 tons

“ and for 1874-75 one of about 166,400 „

“ For the season of 1875-76 no official returns have yet been published, but from well ascertained facts, its production cannot be estimated at more than 10 per cent. over that of 1873-74, which would give about 225,000 tons. Thus the average production of those three years would be about 198,715 tons. Now, in all these years, sugar was imported into Russia, which proves that the above average production was insufficient to supply the demands for home consumption.

“ For 1876-77 we take the production at the generally received estimate of 250,000 tons, which not only sufficed to cover the home demand, rendering importations of foreign sugar unnecessary, but also gave the impulse to the considerable exports, which became possible after the granting of the drawback, and which reached nearly 500,000 pud, or about 8080 tons, before

“the 1st January, 1877, and over 3,000,000 pud, or 50,140 tons  
“from 1st January to the 1st July, 1877. In these figures are  
“included the re-exported surplus stocks of previous exportations,  
“estimated at about 1,000,000 pud, or 16,666 tons, so that the  
“export of home-grown sugar amounted to about 42,000 tons.  
“As no stocks were left at the beginning of the present crop, it  
“would thus appear that about 208,000 tons of last year's crop  
“were used for Russian consumption, which seems to be quite  
“correct, since with a smaller production there were always im-  
“portations.

“With these facts before us, we require only a correct estimate  
“of the present crop, in order to form a trustworthy opinion of the  
“probable exports from Russia this season. It is well known by  
“all who are interested in the Russian sugar industry, that in the  
“whole of Russia and Russian-Poland, with a few solitary excep-  
“tions, the crop of roots has been unusually bad. In many parts  
“barely half as much has been obtained as last year, and all the  
“most competent judges agree, that the whole crop is about  
“one-third less. But inasmuch as the roots are richer in sac-  
“charine contents, the deficiency in this, against last, season's  
“production of sugar is estimated at only 20 to 25 per cent.,  
“which would bring the crop of 1877-78 up to about 187,500 or  
“200,000 tons.

“From this we are justified to conclude that the present season's  
“production of beet-root sugar in Russia will not suffice for the  
“Russian consumption. If, nevertheless, some offers from Russia  
“and Russian-Poland are still to be met with on the foreign  
“markets, they are not the result of over-production, but must be  
“ascribed to that total stagnation of business which is the con-  
“sequence of the present political and financial crisis, and which,  
“owing to the absence of all speculation, may force some of the  
“fabricants, not having the necessary credit facilities, to sell from  
“time to time at low prices for export, though it may be perfectly  
“certain that long before the end of the season all the sugar will  
“be wanted for home consumption, for it is not expected that the  
“latter will fall off in any appreciable degree. It is generally

“expected that, as the manufacturing season draws to a close, so  
“prices will recover from the present abnormal depression, and  
“that, in proportion to the amount of sales prematurely effected  
“for export, we shall witness a considerable advance.

“Independently, therefore, of any interruption of the goods  
“traffic on the Russian railways, it is impossible to count upon  
“the export of sugar from Russia this season. Only a few  
“frontier establishments for whom it may be easier to transport  
“their sugar to foreign parts than to the interior of Russia or to  
“the large Russian refineries, might attempt sales for export at  
“the present low prices, if they were forced by circumstances to  
“realise before the expected improvement.”

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#### A COMMERCIAL CAUSE CÉLÈBRE.

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The important case of *Williamson v. Barbour* has excited the greatest interest in the mercantile world. If the decision of the Master of the Rolls be unappealed from or upheld on appeal, a death-blow will have been dealt at one form of agency remuneration and at the alleged custom of Manchester trade by which it was attempted to be justified. The plaintiffs, Messrs. Williamson & Co., of Calcutta, employed the defendants, Messrs. R. Barbour & Brother, of Manchester, to “purchase and forward” to India Manchester goods. The transactions commenced in 1850 under regular agreement as to terms. There is nothing peculiar about the relations thus constituted between the plaintiff and defendant firms. The one were principals, and the other agents to buy and forward certain goods. The accounts were rendered from time to time, and duly allowed. On what grounds, therefore, have the plaintiffs been able to obtain in their favour a decision of one of our most learned and acute judges, to re-open accounts for some twenty-four years, with the object of establishing against the defendants a claim amounting to nearly £100,000, arising out of these bygone transactions? We all know that fraud will invalidate any deed, however solemnly signed, sealed, and delivered. The learned judge stated no new law

when he said, "When you could show a single instance of fraudulent overcharge as between a principal and his agent the Court would re-open the account." But what were the "fraudulent overcharges" which led the Court in the present case to order the re-opening of long-settled accounts? Before this judgement was delivered, we had in type an article, which appears in another part of this month's issue, entitled "Commission, and Who are Entitled to Take It." \* Our view of the law as there stated was based upon the elementary principle of the law of agency, which requires an agent to disclose and account for, to his principal, all the profits and emoluments arising out of the agency relation between them. Now the facts upon which the Court has acted in the present case show that the defendants did *not* disclose and account for, to the plaintiffs as their principals, their receipt of certain emoluments and profits made by them in buying and forwarding goods on account of the plaintiffs. These profits, so made and not disclosed and accounted for, arose out of the buying, bleaching, packing, and insuring the goods forwarded to the plaintiffs in the usual form of discounts or commissions. Moreover, profit was made by the sale to the plaintiffs of goods actually belonging to the defendants.

Thus we find a course of business directly opposite to the first principle of the law of agency. Still this litigation might have been avoided had full disclosure of the course of business been made to the plaintiffs. It was the concealment which vitiated the settled accounts, and the alleged "Manchester usage" has not been established to the satisfaction of the Master of the Rolls so as to save the defendants from the consequences of their reliance upon it.—*British Trade Journal*.

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SOLUBILITY OF SUGAR IN WATER.—100 grms. of water at 12·5° dissolve 198·647 grms. of sugar, and at 45° 245 grms. In other words, a solution of sugar saturated at 12·5° contains 66·5 per cent., and a solution saturated at 45° contains 71 per cent.—*M. H. Courtonne*.

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\* We have availed ourselves of that article further on.

## JAMAICA A DECAYING COLONY.

The London *Standard* of October 16th published the letter of a correspondent, under this heading, in which he drew a powerful but distressing picture of the present condition of that naturally rich and beautiful island. We refer to it now for the purpose of reproducing some comments upon it by two well-known and respectable West Indian journals,—the *Colonial Standard* and the *West Indian*. The first, after taking some immaterial exceptions proceeds:—The correspondent's letter is an admirable epitome of the manifestations and causes of this country's declension and decay. It is after all a matter of very little consequence whether or not a stranger is pleased with our style of cookery, or with the accommodation of our lodging houses, though even refined hypercriticism of that sort may be turned to good account in inducing us to make all haste to provide ourselves with new *comfortable* hotels. We are not disposed, moreover, to regard a man as reprobate and heterodox above all others even if he does not believe in the unapproachable excellency of the No. 11 Mango! When the *Standard's* correspondent, however, describes Kingston as being "ill-built, unclean, and unsavoury; with ancient and fish-like smells abounding," he merely repeats what the Jamaica Press has for years been in vain dinning into the obstinate ears of a subsidized custos and an insensate government. We condemned the malicious misrepresentations of the *Times* correspondent because he was a venal slanderer; we approve of the *Standard's* correspondent because he is not a flatterer, but a brave, out-spoken proclaimer of wholesome though unpleasant truths. Cæsar did not thank the flatterers who told him that the freckles on his face were stars in the firmament, nor would the sensible people of Jamaica show gratitude to the man who would presume to remove anxiety and alarm by saying, "peace, peace, when there is no peace," or who would dare to fling the soft gloss of cozening words over the social and political sores that require remedy and not concealment. It has been well said that the man who tells us of our faults, aiming at our good, is to be reckoned both wise and faithful; wise in



spying that which we see not; faithful in a plain admonishment not tainted with flattery.

The faults, however, which the *Standard's* correspondent tells us of—though they may wound the *amour propre* of some, are alas! only too well known to us all. We have frequently travelled by the road taken by the correspondent, and, while we can bear testimony to the truth of the picture he has drawn of beautiful scenery and abandoned estates—of the bloom and foliage of redundant vegetation trying, as it were, to hide the nakedness and shame of broken hopes and ruined enterprises—we make bold to say that there is scarcely a district in Jamaica to which these words might not be appropriately applied: “In travelling by way of the roads into the interior, it is impossible not to be struck with the fact that the advance once made by man’s industry has not been maintained. On every side are evidences of retrogression and decay. Cultivated fields have relapsed into wilderness. The fields which once grew sugar-cane are now over-run with jungle. Roofless houses, dilapidated works, and rotting fences testify to the general defeat which the powers of man have sustained in the struggle for existence. Along the whole forty miles of road between Kingston and Annotto Bay, until one reaches the rich low lands near the sea there are hardly any signs of cultivation visible.” Every one who knows anything of the country, will recognize this as a graphic description of scenes that are extensively multiplied throughout the island. It is not for the people of Jamaica to hide or blush for such wide-spread ruin and decay, seeing that the catastrophe has been brought about mainly in consequence of the broken faith and heartless injustice of the mother country. Slavery was abolished—righteously and necessarily abolished—but at the abolition of the accursed system, England assumed duties and obligations which she has never fulfilled or redeemed. Instead of keeping her promise to assist the colonists at the critical stage of disruption and transition, England has, with exceptional pertinacity, thrown every obstacle in the way of the Jamaica planter; and the blatant boasters of what they had done to free the Jamaica slave, became, when they abolished the differential duties, the props and perpetuators of

foreign slavery. Who is there that can deny the truth and justice of the correspondent's charge when he boldly asserts that Jamaica's misfortunes are in a great measure traceable to the pertinacious intermeddling of these pettifogging philanthropists? It has been their constant policy to make a pet of the Jamaica negro, and by their mistaken sympathy for the laborer and their malignant hatred of the employer, they have stirred up dissensions that have, at least, on one occasion, ripened into rebellion; and they have obstinately opposed the introduction into Jamaica of the broad salutary scheme of immigration which has been the salvation of Demerara and Trinidad.

The policy of the philanthropists has attained only half of its manifest object. It has ruined the planter—but it has converted the pet into a vagrant and thief. “The curse of this island,” says the correspondent, “the blight which spoils every local industry, and is rapidly eating the heart out of the community—is the habit of thieving among the negro population, a habit which assumes [here the form of a national calamity. I know of no country in the world which is so weighted and pressed down by larceny as this. It is the one supreme evil of the island, which stops all enterprise and paralyses all industry. The many lazy and worthless steal from the few honest and industrious until the few become fewer, and all are reduced to the one general level of thievery.” This is strong language—but its strength is intensified by its truth. If the correspondent's truthfulness is called in question, he can avail himself of the evidence of the press of the colony that has been for years inveighing against the negligence of Government in not taking any steps to remove or mitigate a great and growing evil, which, like a foul ulcer, is devouring the tissues and poisoning the currents of national life. If the local press is not to be credited, he can refer to the records of the courts of law, the reports of prison inspectors and constabulary chiefs, and even the mild, watery revelations of rosy-coloured blue-books. Above all, he can point to the commission that has been appointed to go up and down the country seeking whom it can save from the swollen ranks of juvenile depravity and crime.

The correspondent condemns the worthlessness and oppressiveness of the system of government with which Jamaica is cursed—but he does not a whit more strongly than is done almost every day by the press of the country—and not half so strongly as the miserable sham deserves. “*In no colony that I have visited,*” he writes, “*and my experience is a tolerably large one of colonies, have I seen a Government more completely out of sympathy with the people and more impotent for good than in Jamaica.*” These are noble, manly words, and we thank God that they have found a place in the columns of the great Conservative journal. They are, however, but the echo of the thoughts and feelings of the press and people of Jamaica. They, nevertheless, inspire us with the hope that we are approaching the beginning of the end. When the island press, a few years ago, gave utterance to such statements, there were in the country a few miserable toadies and lick-spittles who actually had the audacity to stigmatise it as a malignant and Radical press. Radical, forsooth! The wretched creatures had no idea that true Conservatism is founded on order; but on an order that is supported by freedom and justice. Forgetting that Conservatism is frequently most consistent and pure when it is in opposition and “out in the cold,” they were foolish enough to regard as “Radical” whatever was opposed to the blunders and errors of paternal despotism. The press of Jamaica has vindicated its loyal, Conservative character and position. For eleven years it has exposed the imbecility, extravagance, and corruption of the meanest and most malignant form of government that was ever inflicted on a loyal, long-suffering people. Its voice is still raised on the side of constitutional order and legitimate progress, but louder and more effective than any voice which can be borne from a “decayed” colony, is the potential utterance which our great London namesake has sent out to the ends of the world. The cause of truth, however, is not yet completely triumphant; and in our efforts on this side of the water it behoves us neither to flag nor falter. We do not believe, and we do not wish that there should be altogether a change of venue, because in the now celebrated cause of Jamaica *versus* Paternal Despotism the

trial ought to come off on the spot where the crimes have been committed, and where the parties to the cause, the counsel, and the witnesses are to be found. It is important, however, to enlist the sympathy and support of English public opinion, and those who have to fight the battle on this side cannot fail to derive encouragement from the knowledge that their struggles are watched by friendly auxiliaries at home who will ever be ready to throw their talent and influence into the scale of suffering patriotism and violated right.

The *West Indian* has the following, in which we find a very different state of things in Barbados, and one much to the credit of Representative Government: It is a gloomy picture, which we are unwilling to accept as a just view of what was once and might be again the most flourishing British Colony in the West Indies. It deserves the attention of all interested in the future of the West Indies, and more particularly of the Negro race in the West Indies. We would fain look to the emancipated African race to restore the wealth of Jamaica, as it has done in British Guiana and Trinidad, as the writer admits, although he attributes their prosperity rather to the introduction of Coolie and Chinese labourers. They have, it is true, assisted in keeping up the sugar cultivation in these two Colonies, but the creole African labourer forms the principle element of labour in each. But our object is to draw attention to the statements of one who speaks from personal observation, and from the testimony of others resident in Jamaica, in respect of its present condition and future prospects. On the subject of the negro population, he says, "the universal testimony of all those with whom I have spoken in the island—not only planters and merchants, but clergymen and people of independent position, including the more intelligent of the coloured race themselves, warrants me in declaring that the new generation of negroes is worse than the old; worse in morals, in intellect, in capacity for any kind of civilisation." If this is a true picture, it means that emancipation was a failure; and he admits in so many words, that the present system of Crown Colony government is also a failure. The description he gives of the present state of things is in every particular

unfavourable. • Nature has been very bountiful towards Jamaica, but all her gifts are wasted upon the black population and the misgovernment of the colony. \* \* \* \* \*

“The Jamaica negroes,” he says, “will not work; they prefer to live in idleness; and the country is one which enables them to do so. Instead of hoeing canes they like to grow yams and sweet potatoes; and better than growing sweet potatoes and yams, they like to steal them. The large extent of bush land and abandoned estates enables them to gratify these simple appetites in perfection; they are but fulfilling the end of their existence, and no one can blame them. From the negro’s point of view he was quite right not to work when he can live without working, and supplement his few wants by stealing.” If this is a true picture of life in Jamaica, one is induced to ask where is the Government. Are there no laws against theiving, and for the protection of the industrious. If wholesale robbery prevails, is there no police to check it and to bring the offenders to justice. It is not so in Trinidad and Demerara, and why not; because the laws are enforced against stealing. It indicates the defect of the Government, as well as the demoralisation of the labouring people. In Barbados the labouring population is of the same negro race, but how different is their character. No one can justly charge them with a want of industry, and of a desire to better their condition, and to rise in the scale of civilisation. It cannot be said of them that they have not changed for the better by being made free, and put in the position of maintaining themselves and their families by honest labour. They have increased greatly in numbers, and have possessed themselves of land and houses and other kinds of property. Their moral improvement has grown equally with their physical. They have learned to appreciate the value of education, and endeavour to give their children the advantage of school training, denied to them and their progenitors. What is the cause of this difference in the character and condition of the negro race in Barbados and Jamaica. Nature has been kind to both, and especially as the writer shows in Jamaica, where there is a larger field for labour and a greater variety in the climate and in the productions of the soil. Why has

the condition of the Barbados labourer changed for the better since emancipation, whilst during the same period it has grown worse in Jamaica. Is the fault in the labouring people, or in the institutions and system of government, which in Barbados have worked to the good of the people, and in Jamaica in the opposite direction. Is it not to be traced to the action of the Government upon the manners of the people, and to the wise and beneficent legislation for the last 40 years, which has been directed to improve the condition of the labouring population in Barbados, to extend the benefits of education amongst their children, and to fit them for the exercise of the rights of British subjects, conferred upon them by the Act of Emancipation. This is what the lesson teaches us; not to thank God that we are better off than our neighbours, but to show the evil effects of misgovernment. It is not the black population who are to be blamed for the present state of Jamaica, but its rulers—the collapse of the local institutions and the failure of the Crown to provide a proper substitute for them.

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#### COMMISSION, AND WHO ARE ENTITLED TO TAKE IT.

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The columns of some of our leading contemporaries are filled from time to time with correspondence upon the subject of Commission, and the discussion is generally wound up by a trenchant leading article. Still, notwithstanding the recent ventilation of the subject, no clear and satisfactory exposition of the law has been given. This we now propose to do, because such an ordinary incident of the relations of principal and agent should not be left in doubt and uncertainty. Before, however, we come to any statement of the law, let us clearly analyse the actual nature of commission. Commercially speaking, "commission" is a cash payment or cash allowance for a service of agency rendered. Sometimes, in connection with certain services, the term brokerage is used instead of commission. Perhaps the best definition of commission, brokerage, percentage, is to define it as a profit incident to the relation of Principal and Agent. Now it is evident that the payment of commission must

increase the cost of the transaction in connection with which the commission is paid. If, in order to effect the sale of articles of commerce, buyer and seller must be brought together by means of some third person, then the price of the article must be such as will cover the reward expected by the intermediary. And whether material objects or bare services be offered for sale or hire, the principle is the same. Strictly speaking, the term discount should be confined to the consideration allowed by sellers to buyers for prompt payment in lieu of credit. To put the matter another way, it is obvious that if commission no longer entered as an element of cost into commercial transactions, the money consideration involved could be *pro tanto* reduced. The abolition of a tax lowers the prices of the articles upon which it is incident. Thus much for the nature and economic operation of what is termed commission.

Now, who are entitled to take commission? This brings us to one of the main incidents in the relations of Principal and Agent. When one person acts for another in the transaction of any business, there must be trust or confidence between them. Fiduciary relations, with all the legal incidents attaching to them, are forthwith established. Now, what does the law of England and her Colonies, of America, France, Germany, Spain, and Italy, and, indeed, as far as we know, of all commercial communities, regard as an essential and primary basis of the law of Agency. As a common elementary principle in the agency law of all these countries, we shall find that an Agent is bound to disclose and account for all profits, emoluments, and advantages received by him to his Principal, in connection with the business entrusted to him by his Principal; and so to do because the law holds that all such profits, emoluments, and advantages belong to the Principal, and not to the Agent. The Agent, without practising a fraud upon his Principal, cannot accept for himself any profit or advantage other than that which he obtains by stipulation with, or with the knowledge and express consent of, his Principal. This general principle, which underlies the whole law of agency, has been again and again upheld by the decisions of modern tribunals. Now, it is not difficult to perceive the bearing of this principle upon the so-called question of commission. Let us take a case in point. One

M. employed T. to buy a ship, on the basis of an offer of £9000. T. succeeded in purchasing it for £9250, and M. concluded the purchase through T. at that price. It appeared that M., after the conclusion of the purchase, discovered that T. had received the sum of £225 as a commission from the broker employed by the vendor of the ship. M. therefore sued T. in the Court of Queen's Bench for the sum of £225, as money had and received, and recovered it. The Court deciding "that the agent was bound to account to his principal or employer for all profits made by him in the course of his employment or service, and was also subject to a legal duty whenever any profit so made had reached his hands, and there was no account remaining to be adjusted between him and his employer, to pay over the amount, as money absolutely belonging to his employer."

In another case, an army contractor, in supplying an outfit for a customer, had debited that customer with the full amount of the invoice prices charged by the tradesmen supplying the outfit, though discount had been allowed him in each instance. In consequence of litigation about the account, proceedings in the Court of Chancery were taken, and the Court directed the account to be rectified by disallowing the full amount of the discount retained by the army contractor, the Judge observing, "What appears in this case shows the danger of allowing even the smallest departure from the rule that a person who is dealing with another man's money ought to give the truest account of what he has done, and ought not to receive anything in the nature of a present or allowance without the full knowledge of the principal that he is so acting."

We could cite many other cases which decide questions arising in connection with the emoluments received by an agent which he has failed to account for, or pay over to his principal, wherein the decisions have always been adverse to the agent, by reason of the unswerving determination of modern tribunals to enforce the stringent application of the general principle we have alluded to.

The result, then, is, that all persons acting as agents for other persons are entitled to receive commission, brokerage, or other profit or reward, whenever the same is received by them from their principal or employer, or from others with his consent, based upon his



full and complete knowledge. It follows from this that no person who acts for another in any capacity whatsoever can, without rendering himself liable to the most serious consequences, retain any profit he may make out of his employer's business. The policy of the law is conducive to the maintenance of that trust and confidence which must ever be the *sine quâ non* of all commercial transactions. When the buyer in person meets the seller in person they meet at arms' length, for their interests are opposed to one another, and if their respective agents meet they must meet on the same footing. No commission to the agent of the buyer must raise the price against his principal; on the contrary, must be accounted for in abatement of the price to his principal. On the other hand, all commission or share of profit to the agent of the seller must go to raise the price to his principal.

The law is clear; the buyer's agent must buy at the lowest price, the seller's agent must sell at the highest price obtainable; and equity enforced by law does not permit fiduciary relations to be tampered with by self-interest, but requires that the agent's interest shall ever be kept identical with that of his employer.\*—*British Trade Journal*.

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#### TREATMENT OF TOWN REFUSE IN LEEDS.

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The importance to the owners of sugar estates of an ample supply of concentrated nitrogenous manure led us to look with interest upon the process that Mr. Fryer has perfected for dealing with town's refuse, and we willingly found a place for a description when the patent first attracted attention. The subject is interesting mainly

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\* This article is upon a subject which is creating great interest at the present time, in consequence of a decision of one of our Superior Courts, ordering settled accounts to be re-opened for more than 20 years, so that commissions, &c., received and not accounted for to the employer might be ascertained. Attorneys, Managers, and other Agents, for their own protection, should bring into account all commissions, discounts, &c., received by them in transacting their Principal's business, otherwise they would, apparently, have no defence at law from having to account for the same, with interest, for any number of years.—*Ed. S. C.*

in proportion to its success ; for however satisfactory the process, and ingenious the apparatus, it will possess little interest to our readers (save as being the production of one whose name in connection with planting, refining, and sugar legislation are well known) if the system is not adopted. On the other hand if one large city after another makes use of the method, it is evident its importance to the planter will be great. We, therefore, look with satisfaction upon the steady extension of Mr. Fryer's system, and now reproduce an article which bears a semi-official stamp, and which appeared a few days since in the *Leeds Mercury*.—

The local authorities of large towns, in dealing with matters affecting the health of the inhabitants, have many difficult questions to consider ; but, fortunately, science comes to their aid in various ways, and in such things as water supply, drainage, the treatment of sewage, and other matters of vital importance, they are able to command the best advice and assistance, and to them, as representing the ratepayers, the question under consideration thus becomes one of adopting the best scheme at the least possible cost. In Leeds, of late years, great progress has been made with sanitary works ; and, as would be gathered from an article which appeared in our columns some time ago, several very beneficial changes and improvements were then and still are in process of being carried out in different parts of the borough, under the superintendence of the Sanitary Committee of the Town Council. Much yet remains to be done, however, and it will be many years before the Sanitary Committee can stay their hand, and say that they have no more difficulties to overcome and no more enemies to conquer. Among the latest improvements adopted by the Committee, with the sanction of the Corporation, is a new process, patented by Mr. Alfred Fryer, of the firm of Manlove, Alliott, Fryer and Co., of Nottingham and Rouen, for dealing with the refuse of large towns. The committee, as the chairman (Alderman Wood) explained to the Town Council, had nearly exhausted their resources for disposing of the rubbish of the borough, and were compelled to devise some other means. To such straits were they reduced for open spaces on which to deposit the rubbish that the contractor for its removal had appeared before

them, and had stated that he would be compelled to throw up his contract unless the Committee found him some place to which he could cart the rubbish. Wherever the refuse was deposited it became a nuisance to the locality, and everybody objected to have such accumulations near to their dwellings or property. A proposal was made that the rubbish should be carted outside the borough, but that would have involved additional cartage of from six to ten miles, and the increased expenditure was estimated at between £5,000 and £6,000 a year. In these circumstances the Committee directed their attention to the system which had been patented by Mr. Fryer, and which had been tried successfully at Manchester and Birmingham. Mr. Morant, the Borough Engineer, and Mr. Newhouse, the Superintendent of the Sanitary department, visited Manchester, and saw the process in operation. They reported favourably to the Committee, several members of which afterwards visited Manchester, and, having inspected the system for themselves, it was resolved to recommend its adoption by the Town Council. The system includes what are known as the Destructor, the Carboniser, and the Concretor; but the latter Mr. Morant and Mr. Newhouse thought it unnecessary to adopt, believing all that was wanted would be thoroughly accomplished by the two first-named processes.\* The advantage of the system consists not only in the destruction of the rubbish and refuse, with all that is offensive therein, but in utilising it, and converting it into mortar, fine ash, and charcoal, upon which a profit can be made; while, at the same time, there is no expenditure on coal, the fires being fed by the ashes which are brought among the other rubbish. At a meeting of the Town Council, held at the beginning of May last, Alderman Wood proposed that the Corporation should enter into an agreement with Mr. Fryer for permission to use his patent for the construction by the Corporation of apparatus and works at Burmantofts, in accordance with the plan and estimates of Messrs. Manlove, Alliott and Co., at a cost of £2,100; to execute brick and other necessary work in connection therewith, at the estimated cost of

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\* The fluid contents of pails are profitably used in the Yorkshire cloth trade, of which Leeds is the metropolis.

£900 ; and to pay to Mr. Fryer, as a royalty for the use of his patent for twelve months from the completion of the works, the sum of £150, the Corporation to have the power of continuing the use of the patent at Burmantofts and at any other place within the borough, upon payment to Mr. Fryer of the additional sum of £2,000. The resolution was adopted, and the necessary works, which were almost immediately afterwards commenced, were completed a short time ago—the Destructor about the beginning of November, and the Carboniser towards the end of the same month. The Destructor is erected in a square one-story building, and consists of six furnaces, with an underground flue communicating with a chimney, 84 feet high, which has been built a few yards apart from the furnaces. The rubbish from the ashpits of the town is carted up a steep incline, and emptied at the top of the Destructor. Here there are six hoppers, which lead directly to the furnaces. Into these hoppers the rubbish is thrown as it comes—a heterogeneous mass of ashes, broken glass, old iron, utensils, &c.—and there it is consumed, the process lasting about an hour, when the clinkers which have been formed are withdrawn, and the process is repeated. In addition to the hoppers for the ashpit refuse, there are other three hoppers for the purpose of destroying old bedding and mattresses, and such as cannot be properly disinfected. The flames pass downward, and all offensive effluvia is taken away in passing through the fire. The Destructor reduces one ton of ashpit refuse to about one-fourth, namely, five cwts. The iron and glass melt, and become fused with the clinkers. Adjoining the Destructor a mortar mill has been erected, and there the clinkers are mixed with lime and ground into mortar, which is now being used by the Sanitary Committee for building purposes. By this means it is anticipated that a considerable saving will be effected by the Corporation, who have been paying from 8s. to 10s. per ton for mortar, while as much as 15s. per ton has been asked ; and not only will they be enabled to have mortar for their own purposes, but when the works are in full operation they expect to be able to sell mortar to builders at about 5s. per ton. They also expect to be able to dispose of scrap iron, surplus clinkers, and fine ash, the latter available for paving and

flagging, and for the use of market gardeners. The Destructor was at work twenty-six days during the month of November, and in that time 795 tons of rubbish were destroyed, giving an average of 30 tons 11 cwt., per day. The Carboniser, which is very differently constructed from the Destructor, is erected in a one-story building, with eight hoppers on the top, and has a flue communicating with the chimney. It destroys all vegetable and animal refuse from the markets, reducing one ton to about 3½ cwt. The refuse is put into the hoppers, which form rectangular brick cells. From the sides and ends of these are sloping eaves of cast iron. These form an air flue, by which the hot gases from the furnace, which is fed with refuse cinders, pass up underneath the plates and keep them at a dull red heat. The refuse is thus dried, and gradually falls from one eave to another, until it reaches the red-hot plates beneath. From these it empties itself into a brick chamber, and by means of a sliding damper it is drawn off at the bottom, in the form of charcoal, into a wrought-iron barrow. The chambers through which it passes are between 13 and 14 feet deep. The barrow is afterwards taken up an inclined tramway, and its contents emptied into an iron hopper. The charcoal then passes through a revolving cylinder, over which water constantly runs, to cool the charcoal. At the far end of the cylinder is a revolving sieve, which separates the fine from the rough charcoal, and each description is discharged at different points. The Carboniser fires are kept about eight inches thick, so that the gases are nearly deprived of oxygen. The charcoal will be available for sanitary and other purposes, and this it is intended to advertise for sale. The Carboniser only began to work on the 27th of November, and during the first four days it consumed 27 tons of market and other refuse, averaging 6½ tons per day; and of rubbish for fuel it consumed 2 tons 14 cwt. per day. On Monday last the Sanitary Committee, accompanied by the Mayor (Mr. Carbutt), and other members of the Town Council, inspected the works, and expressed themselves as being perfectly satisfied that they answered the purpose for which they were constructed. Some of the large owners of property in the neighbourhood did not at first look with favour upon the erection of the works, but we under-

stand that now, after they have seen them in operation, their views have been considerably modified, as they have not found them to be the nuisance which they expected. The height of the chimney might be increased with advantage. At the Manchester works the chimney is 160 feet high. At Birmingham the chimney was about 120 feet high, but it has been increased to 170 feet; and we were informed by a member of the Birmingham Corporation, who visited the Leeds works yesterday, that since the addition had been made about one-half more rubbish had been consumed per day. We may mention that Carbonisers are now being erected by the same firm in Krälingen, in Holland.

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HEAD AND SCHEMIOTH'S PATENT FURNACE FOR  
BURNING VEGETABLE SUBSTANCES; SUCH AS  
STRAW, REEDS, MEGASS, COTTON STALKS,  
&c., AS WELL AS WOOD AND COAL.

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Among the many important inventions of the present day there appears to us not one calculated to play so important a part in the development of steam machinery and particularly in countries abroad, as the new furnace designed by Messrs. Ransomes, Sims, & Head, of Ipswich, for burning vegetable substances.

To us who live in a country where coal is cheap and plentiful that substance is the only kind of fuel which suggests itself to our minds, but in the East and West Indies, Egypt, South America, and as near home as Russia, and the Danubian principalities, coal is, as a rule, unobtainable, except at a price which, so to speak, places a heavy tax on all employers of steam power.

In various countries however where wood and coal for fuel are not indigenous, large quantities of light dry vegetable substances such as straw of all kinds, reeds, brushwood, cotton stalks, refuse of sugar cane, &c., exist. These substances are, as a rule, of no value whatever and in many cases a positive embarrassment, we have heard that in Russia, Hungary, and the large corn growing districts of the Danube, the surplus straw is so worthless that it is collected

together by the farmers there into large heaps and allowed to rot, or it is burnt on the field. The same practice prevails in many parts of our Australian colonies, the Cape of Good Hope, and South America, and one large farmer in New Zealand in writing home to England about an engine fitted with Messrs. Ransomes' patent furnace, says, "Had I had one, years ago, it would have saved me a great deal. I have burnt thousands of tons of straw to get it out of the way and have had to get coal and wood to thrash with."

On the vegetable substances to which we have referred the minds of engineers rested when endeavouring to solve the great difficulty of finding a cheap fuel for steam engines in countries where coal was not indigenous.

In order that some comparison may be formed of the value of the various substances which can be used as fuel in steam boilers we extract the following table from a paper read by Mr. John Head, C.E., before the Institution of Civil Engineers, which will show their chemical composition in the ordinary air-dried condition:—

	Carbon.	Hydrogen.	Nitrogen.	Oxygen.	Sulphur	Ash.	Water.
Coal, coking, Newcastle	80.33	5.72	2.03	7.78	0.74	2.05	1.35
" " S. Wales.	82.32	6.09	4.54	1.48	0.76	3.99	0.82
" non-coking "	88.62	4.40	1.23	3.23	0.54	1.19	0.79
" " S. Staf- fordshire . . }	74.54	4.95	1.01	8.50	1.19	1.95	7.86
Lignite, Bohemia . .	58.29	4.68	0.80	17.62	0.71	5.30	12.60
Peat, Ireland . . .	50.13	5.06	0.76	26.85	..	2.83	14.31
Wood, oak. . . . .	41.02	5.13	0.86	35.11	..	1.83	16.05
" pine . . . . .	41.99	5.26	0.75	35.98	..	0.63	15.39
Straw, wheat . . . .	35.86	5.01	0.45	37.68	..	5.00	16.00
" barley . . . . .	36.27	5.07	0.40	38.26	..	4.50	15.50

The average calorific effect found in practice to exist in coal and other products, when used as fuel, is as follows:—

1 lb. of good coal	...	...	...	...	...	...	Will evaporate 6 to 7 lbs. of water in an ordinary tubular boiler.
2 lbs. of dry peat	...	...	...	...	...	...	
2.25 lbs. to 2.30 lbs. of dry wood	...	...	...	...	...	...	
2.50 to 3 lbs. of cotton stalks, brushwood, or megass	...	...	...	...	...	...	
3.25 lbs. to 3.75 lbs. of wheaten or barley straw	...	...	...	...	...	...	

No chemical analysis of megass or cotton stalks has as yet been

made, but from experiments which have taken place with them as fuel in tubular boilers, their calorific value may be reckoned at about equal to wood.

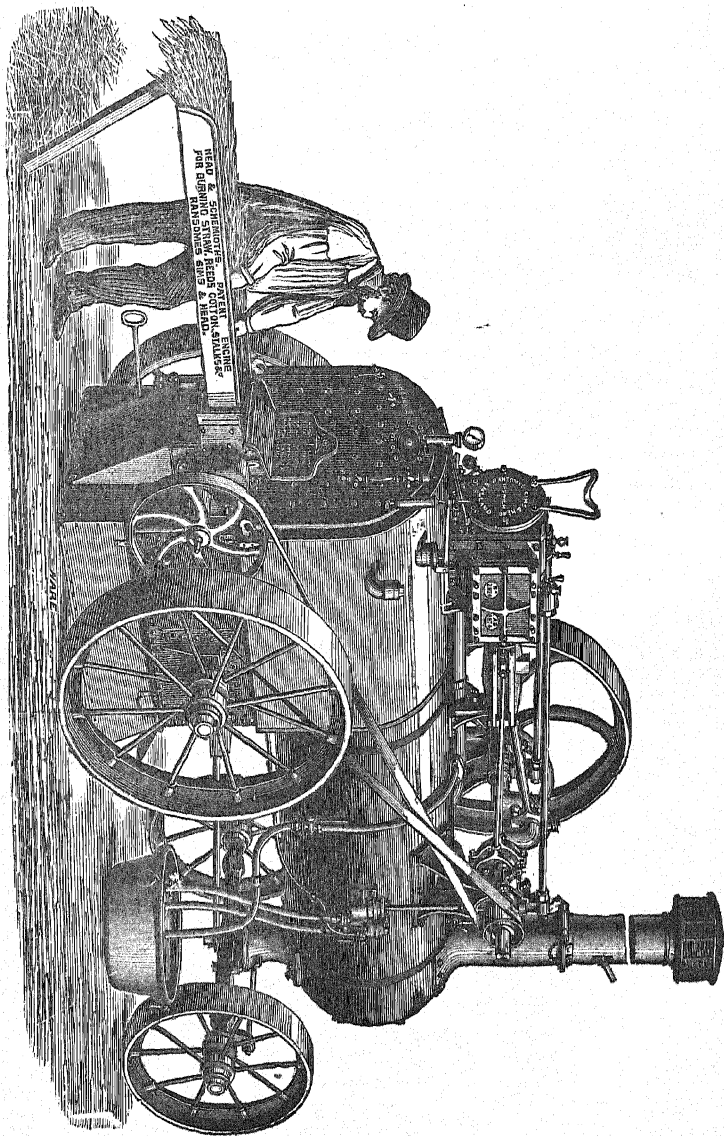
Straw being generally the vegetable substance which offered itself in the greatest abundance it was not to be wondered that the first attempts to utilise it as fuel were made with engines of the "portable" class now so largely used in all agricultural operations. In some of the first experiments which were made to solve this problem, pits were dug in the ground over which the fire box or the furnace of the engine was placed, straw was then burnt in these pits, and a sort of qualified success was obtained, steam was kept up with a certain amount of regularity, but the action of the flame was particularly detrimental to the fire box plates of the boiler and soon destroyed them. Various forms of fire boxes were also tried but were all arranged to feed the fuel *en masse*, which, therefore, only smouldered and would not burn with sufficient rapidity to produce the quantity of steam necessary for the engine.

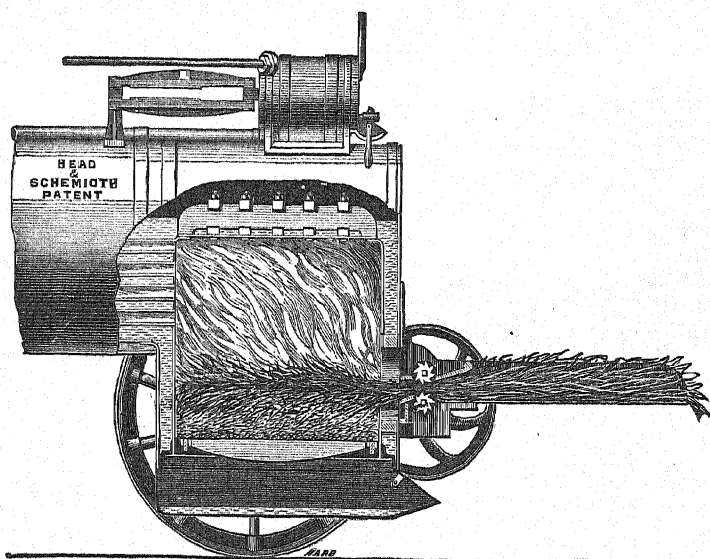
At the Vienna Exhibition, however, in 1873, an engine was brought out by Messrs. Ransomes, Sims, & Head, which fulfilled all the conditions required, and to which the "Diploma of Honour" was awarded. We have therefore thought that a short description of this engine will not be uninteresting. We are able also to furnish some illustrations which will assist much to understand the theory of this invention.

As will be seen by the engravings, on pages 34 and 35, these patent engines do not differ materially in their general construction from those of the ordinary portable type. The principal points of difference are that the fire box is larger and a greater number of tubes are employed, in order to increase the heating surface. The apparatus for feeding the straw, reeds, and other fuel, into the fire box, consists of two toothed rollers placed at a minimum distance of about a quarter of an inch apart, and capable of rising so that the distance between them can be increased to one and a-quarter inch. The lower roller is set in motion by means of a strap from the crank-shaft of the engine, and makes about 45 revolutions per minute. The upper roller moves at the same speed, and is



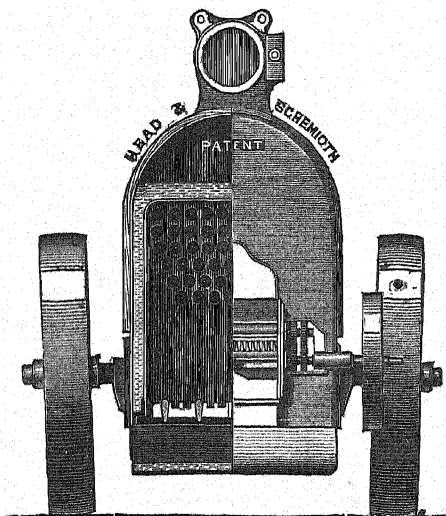
PERSPECTIVE VIEW OF HEAD AND SCHEMIOTH'S PATENT PORTABLE  
ENGINE FOR BURNING VEGETABLE FUEL.





SECTION THROUGH FIRE-BOX.

Showing position of Straw or other Vegetable Substances in process of combustion.



END VIEW OF ROLLERS AND FIRE-BOX.

connected with the lower one by means of long toothed wheels. The rollers are carried on a cast iron frame, to the front of which is attached a trough for receiving the supply of vegetable fuel to be fed into the furnace. The rectangular space between the rollers, which serves as a passage for the fuel into the boiler, is placed from 4 in. to 5 in. above the fire bars, this distance having been found by experience to give the best results, as by injecting the fuel at this point the fresh substance forces its way into the centre of the burning mass inside the fire box, and ignites more quickly than when it falls on to the top of the flame. The theory of the invention is, that by means of a continuous mechanical feed, the fuel can be forced into the furnace in a thin stream in the form of a fan, and the fresh fuel is practically held in suspension for a short time, allowing the separate stalks to become immersed in the flames, and the long pieces of straw, reeds, or brushwood, to have the effect of stirring up the half-burnt material in the furnace, thus keeping the whole in motion besides permitting a proper ingress of atmospheric air, which is necessary for the rapid combustion of vegetable matter.

These engines are quite as easy to manage as those of the ordinary type and in Russia and on the banks of the Danube, a saving of nearly £2 per day is effected by their use. A great many experiments have been made with these engines, both in England and abroad, and the average consumption of vegetable fuel has been found to be about 2.50 to 3.25 times the weight of coal that would be required, and it is found in thrashing that about eight sheaves of straw are required to thrash one hundred sheaves of wheat or barley.

Since the Vienna Exhibition in 1873, several hundred engines fitted with the patent apparatus, have been manufactured, and exported to the various countries we have mentioned, and we hear from all parts, that they are giving the most complete satisfaction.

The great point of interest to our readers will probably be, the application of this apparatus to fixed boilers. Messrs. Ransomes have already sent out a number of these patent feeding arrangements, both with boilers complete, and for attachment to boilers already at work.

We are informed that about 3 years ago, His Highness the Viceroy of Egypt instructed some trials to be made with this patent apparatus for burning megass as fuel, and several experiments took place before some eminent engineers in Egypt, and the following was the result:—

The engine was of 10-horse power; the diameter of the cylinder 10 inches, with a length of stroke of 13 inches; the pressure of the steam 70 lbs. cut off at one third; the revolutions 140 per minute; and the consumption of cotton stalks amounted to 3 cwts. In one hour and two minutes and a half, the load on the break being 18-horse power; the consumption of cotton stalks per horse power per hour, was 17·92 lbs. which, taking 6 lbs. as the average consumption, by this engine, of coal per horse power per hour, gives the proportion of the consumption of coal to cotton stalks as 1 to 2·98.

Although no experiments have actually taken place yet, several designs have been made for attaching this apparatus to fixed boilers in sugar factories, for feeding them with megass, and probably ere long some adaptation of the invention will be made. It is proposed that the rollers should be worked either by hand or steam power, and it is necessary to have the front of the apparatus and the front dead plate and bars much inclined for this description of fuel, otherwise the rollers would not be able to keep it in proper motion, owing to the pieces of megass being usually rather small, and inclined to agglomerate. By this apparatus a thin stream of fresh megass would be continually injected into the furnace, so that the unconsumed fuel should gradually force the half burnt and burnt megass towards the end, where the combustion is most active. Another advantage would be that instead of throwing the fuel on to the top of the fire, which has been proved to be unsatisfactory, when using vegetable refuse, the apparatus would force the fresh megass into the centre of the coldest part of the burning mass, thus supplying the fire with fuel without checking the evolution of the gases, produced by combustion in the middle and end of the furnace.

Many of these engines are at work in Egypt, for irrigating, using only the refuse of the cotton stalks for fuel, and it has been found

that the waste cotton stalks produced by one acre, are sufficient to generate steam enough to irrigate that acre of land.

We think this new engine, and the application of the patent feeding apparatus to fixed boilers, is well worthy the attention of all users of steam power, in countries where coal and wood are scarce, and where vegetable refuse of all sorts are plentiful.

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### ON THE TESTING OF LUBRICANTS.

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At the fifth meeting of the present session of the Manchester Scientific and Mechanical Society, held on Wednesday night, 12th November, 1877, Mr. Isaac Bowes in the chair; Mr. W. H. Bailey, of the Albion Works, Salford, read a paper on "Some means used for testing lubricants," the subject being illustrated by models and diagrams. He stated that in recent times the valuable discoveries of their townsman, Dr. Joule, had enabled them to look upon the cost of friction and the cash value of heat as a mere question of arithmetic. Dr. Joule's investigations had been put into such elegant English by Professor Tyndall and other students of the science of force as to cause them to understand that when friction was produced heat was lost, and that all energy thus wasted passed away in heat, which heat might be measured and valued with nearly as much facility as any article of commerce. If a pedestal or bearing became so hot through friction as to cause one pound of water to be raised one degree (Fahrenheit) in temperature in one minute, heat had been lost equal to that which would be caused by a weight of one pound falling through a space of 772 feet, and, if they applied this conversely, heat had been lost which would lift one pound weight 772 feet. The heating of 40 pedestals or bearings in this manner would give a loss equal to one-horse power. Good lubricants should have the following qualities: 1. Sufficient body to keep the surfaces free from contact under maximum pressure. 2. The greatest possible fluidity consistent with the foregoing condition. 3. The lowest possible co-efficient of friction. 4. The greatest capacity for

storing and carrying away heat. 5. A high temperature of decomposition. 6. Power to resist oxidation, or, in other words, the influence of the atmosphere upon it. 7. Freedom from corrosive action upon the metals upon which it is used. It will thus be seen that many conditions have to be carefully taken into consideration; and further, it may be stated that as oil which may be good for heavy bearings may not be desirable for use on light spindles and for delicate machinery like clocks and watches, where very little power is required to be transmitted beyond that of overcoming their own inertia. For very heavy bearings tallow and other solid lubricants are used, such as mixtures of sulphur and tallow, asbestos, soapstone with asbestos, graphite, caustic soda, beeswax, and other similar mixtures which find favour among locomotive engineers and those in charge of heavy machinery. The pressure that can be borne by a lubricant for a useful length of time depends upon the nature of the bearings as well as upon the lubricant itself. The velocity of the rubbing action must also be taken into consideration. The maximum of pressure that solid lubricants will bear without destruction is unknown. For steel surfaces, lubricated with best sperm oil, moving slowly, 1200 lb. pressure per square inch of bearing surface has been found permissible. Under the pivots of swinging bridges several thousand pounds per square inch have been found to work. For iron journals, 800 lb. per square inch should not be exceeded. Mr. Bailey proceeded to describe several methods of testing lubricants, including the machine invented by Mr. Henrich Stapfer, and the similar one invented by Professor R. H. Thurston, of the Technical College, at Hoboken, New Jersey, U.S. The Thurston tester, Mr. Bailey said, consists of a journal carrying a small shaft in two bearings. This journal is grasped by brass steps, which are connected with a pendulous weight. These brass steps are forced against the journal by means of a screw which compresses a coil spring. The amount of this pressure is indicated on a scale like that of a spring balance. A "bob" at the end of the pendulous arm gives the weight necessary to resist deflection. The angle of deflection is measured on an arc or quadrant in such units that the

division of the figures may be read off, and give, not only the angle of deflection, but also the co-efficient of friction. A thermometer on the top brass gives the temperature in a manner similar to that of the Stapfer tester. Mr. Bailey said that he had prepared a pendulum test, which he thought might be found useful in testing oils which will not be subjected to high speed or to very heavy pressures, such as the conditions under which oils will be used for clocks and watches. This consists of a pendulum to which is attached a silk cord, which imparts a reciprocating motion to a small piece of brass, by simply placing one drop of oil on the surface of the brass and noticing how many times the pendulum will vibrate without stopping. Useful information may be obtained about the value of a lubricant when not subjected to heavy wear and tear. It would be obvious that however good as a lubricant an oil is, and however valuable its properties may be when examined, if it possesses any corrosive quality which will be injurious to the metals upon which it is placed, it will soon become detrimental to the machinery, and also may cease to be valuable as a lubricant.

A brief discussion followed the reading of the paper, and a cordial vote of thanks was passed to Mr. Bailey.

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### THE SUGAR INTEREST IN PERU.

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In a previous issue of the *Sugar Cane* we gave a paper on "The Sugar Machinery of Peru." We now submit the following as a suitable and interesting sequel:—

It is singular how exotics are becoming the ruling objects in Peru—Europeans, horses, sheep, sugar-cane, coffee, oranges, grapes, bananas, wheat, eucalyptus trees, &c. Peru, though rich in minerals, was never plentifully supplied with useful animals and plants; but, possessed of every conceivable variety of climate and soil, she has shown herself capable of giving a congenial home to every form of life. Northern and Southern Europe can meet in this little Republic.

Among the foreign introductions, always excepting the immigration of Europeans, the sugar-cane is the most important. Better than guano or saliter, it is destined to be the surest and most inexhaustible source of the wealth of Peru. The annual yield of sugar and spirits is estimated at £5,000,000. The recent rise in the price of sugar has given a new impulse to its cultivation, and the prospect is that Peru will ere long be a formidable rival of Cuba and the other Indies. The usual cane crop in the West Indies is 1,130,000 tons; in Java, 200,000; in Brazil, 170,000; in Louisiana, 75,000; in Egypt, 40,000. The crop in Cuba last year was thirty per cent. below that of 1875, while the beet crop in France and Germany was well nigh a failure. In 1875, Peru exported 60,000 tons; in 1876, over 70,000. That amount will be greatly increased this year, provided labourers can be obtained. But thousands of acres are lying idle for want of hands. In fact, the commerce of Peru is diminishing for lack of labour and capital, and Peruvian statesmen are anxiously looking to China for the one and to Mr. Meiggs\* for the other. The squint-eyed Celestials outbid and outdo the mongrel races along the coast, and the mountaineers cannot endure the lowlands. But Chinamen must be better treated than they have been. Even now, great as is the demand for foreign labour, the natives, as in Trujillo, would persecute the Asiatics and drive them from their shore.

In no other country, save Egypt, is the cane crop so sure as in Peru. Occasionally, as in 1871, the crop may suffer by drought from want of the supply of water from the sierras; but in the course of ten years the decrease would not amount on the average to more than twenty-five per cent. As the cultivation is regulated by irrigation, as in Egypt, Peru has an advantage over Cuba, where planters depend on the weather. At present Peru can compete with any other country, save Egypt, since she can grow the cane without intermission. The slave labour of Cuba cannot produce it so cheaply. The cane grows more slowly than in Louisiana, and hence is richer in saccharine matter. The amount of juice in the

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\* This gentleman is since deceased.



cane is about sixty-five per cent., and its average density is 10°. In Northern Peru two tons of cane give four hundred gallons of juice, each gallon yielding 1·35 lb. of sugar. The best season for planting the cane is November, and the yellow variety (originally from India) is preferred to the red, being richer. The first planting takes fifteen months to mature; after that the crops ripen every twelve months. This is true only of Northern Peru, where the soil is thinner but more tropical than at the south; in Caneta, for example, it takes fully two years for the first crop to mature. Three or four crops are obtained before replanting is necessary. The green and ripe cane are seen in the same field; there is cutting on one end and planting at the other; so that the ground is never idle. The actual time spent in the manufacture of sugar is eight months; the rest of the year is occupied in repairing acequias, &c. From the small establishments the sugar is exported in the crude "concrete;" in the larger mills, it is first refined. For inland transportation, western Bolivia being supplied from Peru, it is put up in conical loaves, weighing 45 lb. each. Under the present American tariff refined sugar goes by New York to Europe, *the law favouring the New York refiners without benefitting the consumer or the Government revenues*. Then, too, the Hawaiian Reciprocity Treaty, allowing free importation of sugars from the islands, tends to turn the sugar of Peru across the Atlantic.

The sugar-cane is cultivated on both sides of the Andes, but it does not grow at a higher altitude on the western slope than 4500 feet, while on the eastern side its limit is 2000 feet higher. In the Marañon region, as at Moyobamba, Tarapoto, Aipena, and San Regis, and also in the Urubamba Valley (Upper Ucayali), it grows luxuriantly, but will not give crystallised sugar; so it is turned into *aguardiente*. There the cane ripens in six or seven months after planting. Considerable sugar of excellent quality is manufactured at Abancay on the Apurimac, but rudely purified with clay; it is mainly consumed in Cuzco, where it brings forty cents a pound.

But the Pacific slope of Peru, particularly of northern Peru, is the great sugar district; there it is fast taking the place of cotton and rice. The whole coast presents a series of arid wastes and

fruitful valleys—alternating Saharas and Edens. Nothing is wanting but water to convert the entire coast into a garden twelve hundred miles long. But it is worthy of remark that, wherever the railroads run from the coast into the mountains, they seem to have changed the meteorological character of the lowlands, rains being more frequent on the coast terminus than formerly.

Every port above Callao exports sugar, those of Talaverrey and Eten taking the lead. There are about one hundred and twenty large sugar estates on the coast. Lambageque and Chiclayo contain eighteen, of which that of Patapo is the chief, and probably the largest in the country. It guarantees £1000 a month freight to the railroad. The Pacosmayo Valley has fifteen, of which the "Lurifico" is the most important, and to which I shall recur. The rich valley of Chicama near Trujillo is crowded with sugar plantations: its twenty-four mills produce to the value of one million dollars per month. The machinery is English. The "Casa Grande" of Sr. Albrecht is the most complete. Further south, near Chimbota, in the Valley of the Santa, are two large establishments, "Puenti" and "Viuzos;" the former has American machinery precisely like that of "Lurifico," only the charcoal process is not used. Chonca, just above Lima, has fifteen estates, of which "Palpa" is the largest; while around the capital are more than twenty, among them the well-furnished establishment of "Santa Clara." In the valley of Caneta are the extensive plantations of the late Henry Swayne, 2500 acres being under cultivation. There are also numerous cane estates in the departments of Ica and Arequipa, but they yield comparatively little sugar.

The "Lurifico Hacienda," near Pacosmayo being a representative establishment, I will describe it. The estate was once the property of the unfortunate President Balta, afterwards of Henry Meiggs. It now belongs to Mr. Ford, of the house of Dreyfus and Co., and is under the superintendence of Mr. Kauffman, from Ohio. Two thousand acres are covered with sugar-cane, the rest being given up to rice for the labourers. English steam ploughs are used in cultivation. The mill works were designed by Cahill, and constructed by Morris, of Philadelphia. They cost when put up

£50,000. The engine is 90 horse power, and the roller weighs 12 tons. Three small locomotives from Paterson, N.J., bring in the cane from the field, and discharge it upon a "conductor" seven feet wide and 150 feet long. The dried pressed cane, called "bagass," affords all the fuel used for engine and locomotives. There are 12 copper "defecators" or purifiers, each holding 400 gallons; when full fed, the mill can fill 80 defecators daily. In the defecators, the juice, "*guarapa*," is treated with lime, and heated by steam to  $140^{\circ}$ , to remove acid and scum. Thence the liquor goes to two of the twenty filters filled with animal charcoal, and next into large iron tanks, whence it is transferred to three copper "vacuum pans" in succession, No. 1 having a vacuum of 6 inches, No. 2 of 18 inches, No. 3 of 22 inches. In these it is boiled by the exhaust steam. When it leaves the third pan, it has a density of  $27^{\circ}$ , and is called "syrup." Carried to the clarifiers, where it is treated with steam to remove more scum, it passes next into the rest of the charcoal filters, and then into two other iron tanks, from which it is drawn into a fourth copper exhaust pan, called "strike-pan," with a vacuum of 25, where it is boiled for one hour till it becomes a thick syrup. Then, by letting in a small portion of thinner syrup, it grains, and by continuing this, the size of the grain increases. From the strike-pan it goes into the "coolers," which are pans five by six feet on rollers. When cold, it is transferred to the "mixer," where it is stirred by machinery, so that it will run into the "centrifugals," which make 1200 revolutions a minute, to be deprived of its molasses. The cross-grained sugar thus made is called "muscavado" or "granulado" No. 1, and is exported in bags. The grains are apparently cubes, but are really monoclinic prisms. The molasses is taken to the "blow-up," where it is subjected to jets of steam, skimmed and taken to the strike-pan, and made into sugar No. 2. The refuse molasses and *guarapa* are taken to the distillery, and put into large vats for fermentation, 13 all told, 10 feet deep and 10 feet in diameter; thence to the still, rectifiers, and condenser. Every day 1400 gallons of rum of  $40^{\circ}$  are made.

The Lurifico works are capable of turning out per day 35,000 gallons of juice, requiring 175 tons of cane, or nearly 50,000 lbs. of muscavado. The length of the process from pressing the cane to bagging the sugar is two days, including one for cooling. In the field and mill there are 939 Chinamen, who get two rations of rice per day, one dollar a week, and two suits of clothes a year. They all live within a small enclosure called "*Galpon*," adjoining which is an excellent hospital under the charge of Doctor Heath. They work ten hours a day—five hours before breakfast, and five hours in the afternoon. On Sunday, which is pay day, they work but four hours. In less than four years the majority will be free, as their term of servitude will expire ; some will re-contract for a year or two at higher wages, but many will set up for themselves, for the great ambition of the more intelligent Chinamen is to keep a shop or *fonda*. The labour question is, therefore, constantly revived, and is the uppermost topic at the sugar *haciendas* of Peru.—*Professor James Orton, in the "Scientific American."*

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### THE BLACKBURN CENTRAL MILL.

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Thirty years ago, on the 11th of September last, Lot No. 21, on the Great Umhlanga River, now the site of the Blackburn Central Mill, was publicly offered for sale, and purchased by Philip Jacob Jung and Jonas Bergtheil, for two shillings per acre. Seven years afterwards it was sold to Charlotte Eve, wife of Samuel Rodolf, for £50 less than it cost the original purchasers. Mrs. Rodolf does not seem to have valued her purchase highly, for she sold, in the following year, these 1743 acres for £200, making £77 profit on the transaction. The purchaser was Joseph Blackburn, after whom the estate has continued to be called. It was divided into lots in 1864, nine years after Mr. Blackburn's purchase, and the village of Blackburn, containing 65 acres, laid out. The various lots, ten in number, realised about £3 5s. per acre, and were bought by intending coffee planters. In 1876, the Blackburn Valley was beginning to be dotted over with what it was hoped at the time

would be thriving coffee plantations. Messrs. Turton, Flanders, Campbell, Turner, Couper, Smerdon, Adams, and Saner cultivated land on this original block. The coffee tree proved a failure, and is giving way to its successful competitor, the sugar cane.

This land, which 30 years ago was sold for 2s. per acre, was valued the other day, for the railway tax on immovable property, at from £6 to £7 per acre, exclusive of crops and buildings.

Such is the history of the land on which the fabric we are now going to describe stands. Some three years ago, when it was already apparent that the coffee cultivation of the district was a failure, the attention of the owners of the land was, by force of circumstances, turned towards finding some other means of utilising their broad acres. The press of the colony had called attention to the central mill system of other countries, notably the West Indian Islands. At a meeting of the inhabitants the subject was discussed. Mr. J. R. Couper, the present general manager of the Glasgow Natal Sugar Company (Limited), stated that if sufficient inducement offered he would be willing to lay the matter before his Company. The outcome of this meeting is the fabric now standing on the banks of the great Umhlanga. At present there are 2210 acres which contribute cane to this mill, perhaps the largest block of good land to be found in the colony of Natal. The terms on which the mill works are—the growers cut and load the cane, and the company transports from the field and manufactures the cane for a half-share of *all* the produce.

The company having imported a weigh bridge, it is hoped that, after the trial of a year or two of the weights of cane, a system of buying cane by weight outright will be established, and thus save the expense of separating treacles, &c., for the respective half-shares, besides allowing the smallest holder of land to become a sugar planter. The sugar mill lies in a bend of the great Umhlanga River, between the main north coast road and the Blackburn road. The main building is 160 feet long by 73 feet broad, covered by an iron roof, constructed by Messrs. P. & W. McLellan, of Glasgow, consisting of 15 principals and one louvred end, with ventilator running the full length of the roof. The boilers, three in number,

stand at the south-west corner of the building, under a lean-to roof. They are each 12 feet long, and  $6\frac{1}{2}$  in diameter, multitubular, with patent removable tubes. The chimney stands some distance from the main building, 96 feet above the main flue; the foundations and base are built of sandstone blocks, the upper portion of the shaft with brickwork. A steam donkey pump stands near to the boilers, but in the main building, for feeding the boilers and supplying the works with water, for which purpose pipes have been laid from a cistern, placed on the roof, to the subsiders, clarifiers, concrete trays, still-house, &c.

To a Natal visitor to these works, the size of the cane rollers and their engine strike one more than anything else. The rollers are 32 inches in diameter, by six feet in length; they are fed by a cane carrier 30 feet long, driven in the usual manner, from one of the rollers. The megass is lifted by a 20-foot elevator. The rollers are driven by a horizontal engine, with a 22-inch cylinder and 4-foot stroke. The speed is governed at 32 revolutions per minute, giving the mill 16.3 feet of roller surface per minute. From the rollers the juice is conveyed by a cast-iron gutter to the sulphur churn (Stewart's patent), close to which is a sulphur furnace and shower bath. After passing through the churn, the juice is lifted by a powerful pump, attached to the intermediate gearing shaft, into the clarifiers, being heated on the way by passing through a vertical multitubular juice-heater. There are six 700-gallon clarifiers, each fitted with solid drawn brass heating tubes, two inches in diameter and seven feet long. They stand on a floor, supported by iron columns, above the subsiders. The clarifiers are heated by exhaust steam from the cane engine; direct steam is also laid on, to be used if required. The clear juice runs from the clarifiers to the Concretor supply tanks, placed at the head of the trays. The two sets of trays are in the south-west corner of the building, the one "right," the other "left," placed so as to allow the liquor to gravitate to the subsiders; a range of twelve, each containing 800 gallons, standing under the clarifiers on the north side of the building. Two of these subsiders are furnished with steam copper heating coil, to be used as blow-up pans. The clear liquor runs,

after subsidence, to the supply tank of the vacuum-pan; the liquor from the bottoms of subsidiers runs into a *mont jus*, and is raised again for further clarification, or to be sent to the still-house. The vacuum-pan, which is made of cast-iron, stands on a raised floor, supported by cast-iron columns, nearly in the centre of the building. It is eight feet in diameter, and eight feet deep, fitted with four sets of copper heating coils, together with a copper steam jacket.

The pan is worked by a Robertson's patent valveless engine, driving an improved double-acting horizontal pump, depending, for its action, upon the displacement of water by an egg-ended plunger. The cylinder is 12in. diameter, with a 24in. stroke. The engine makes 70 revolutions per minute. The pan "worm" is in four lengths, which are heated from a main pipe, which receives the exhaust steam from the various engines in the factory. In case of need, direct steam can be used, by the aid of an Auld's patent reducing valve in connection with the boilers. To prevent back pressure on the engines exceeding 10 lbs. to the square inch, a loaded valve is attached to the range of exhaust piping. The vacuum pan discharges its contents into trucks, 6ft. by 5ft. by 3½ deep, two of which hold a full skip of the pan. There are twelve of these trucks standing on rails in sidings opposite the centrifugals. Traverser carriages are employed to run the trucks from the sidings to the vacuum pan or to the pug-mills, as may be required after the *masse cuite* has been allowed to cool and crystallise. From the sidings the trucks run up to the pug-mills, one of which feeds two of Weston's patent sugar-drying centrifugals. There are four of these centrifugals, mounted on independent iron framing, and driven by a diagonal engine.

The dry sugar is delivered from the centrifugals on to a carrying board, which deposits it into an elevator, which in its turn deposits it on the sugar drying floor at the east end of the building; on the south side of the building, and opposite to the sidings, the rum still and appliances are situated. The still is of copper, 600 galls. capacity, fitted with tubular rectifier and retort, steam gear, heating coil, &c., and is capable of producing 12 galls. of 10° over proof spirits per hour. On the south side of the building there

are lean-tos, covering store-rooms, Queen's warehouse for rum, and the necessary offices for carrying on the business of an extensive factory. The whole building is roomy and capacious, and the mistake of crowding all into a narrow compass has been avoided.

The whole of the machinery has been supplied by Messrs. Mirrlees, Tait, & Co., of Glasgow, and has been erected under the care of their superintendent here, Mr. Llewellyn Jones. It is due to the skill and untiring energy of Mr. Llewellyn Jones that the factory has been so quickly erected and got ready for work. On Tuesday, the 2nd of October, this mill began its season's work; it will be a week or so before it gets into full swing, and then it is fully expected to do from eight to ten tons a day. Mr. Cowley, the veteran builder, has had the superintendence of the brickwork and other building operations, which have been carried out with his usual skill. Mr. Morrison is the manager of the mill and plantation, and now takes over from the engineers and builders the finished central mill. We believe it is intended to complete the machinery by adding a Concretor drum to assist in increasing the density of the juice, and thus saving the work of both trays and vacuum pan.

In conclusion, we have much pleasure in congratulating Mr. J. R. Couper, the general manager of the Natal Glasgow Sugar Company, on the success which has so far attended his efforts in advancing the Central Mill system; and wish his Company every success, trusting that this mill will be but the forerunner of several more to be erected under his auspices.

The tonnage expected this season is 800; had it not been for the drought, fully a third more might have been anticipated.—*Natal Mercury*.

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With reference to the letter of a "Trinidad Planter," which appeared in our last issue,—the difference in richness of a saccharine solution given by the polariscope, when compared with that derived from the specific gravity of a solution, is, generally, in cane juice, from 1 to  $\frac{3}{4}$  of a per cent.; and the average ratio of difference in the amount of molasses made, when working the old and new systems, is, we should say, from two-fifths to one-seventh, when the canes are in good condition, and the work carried on quickly and carefully.



We have received the following statements, from a reliable source, on the eve of going to press:—

CROPS.					
	1877-8. Estimate. Tons.		1876-7. Tons.		1875-6. Tons.
Beet .....	1,265,000	....	1,059,382	....	1,343,839
Cane .....	2,070,000	....	1,928,165	....	1,910,545
	<hr/> 3,335,000		<hr/> 2,987,547		<hr/> 3,254,384
STOCKS, &c.					
	1877 Tons.		1876 Tons.		1875 Tons.
United Kingdom.....	168,430	..	86,093	..	130,462
France.....	148,939	..	154,811	..	174,395
Holland .....	11,046	..	3,386	..	10,962
Germany .....	48,940	..	22,265	..	23,200
	<hr/> 377,355	..	<hr/> 266,560	..	<hr/> 349,019
United States .....	66,576	..	17,956	..	48,000
	<hr/> 443,931	...	<hr/> 284,516	..	<hr/> 397,019
Havana and Matanzas ..	47,536	..	24,802	..	38,803
Afloat .....	58,346	..	50,604	..	69,325
	<hr/> 549,813	..	<hr/> 359,912	..	<hr/> 500,147

### THE RAIN TREE.

The Consul of the United States of Colombia, in the Department of Loreto, Peru, has recently called the attention of President Prado to a remarkable tree, which exists in the forests adjoining the village of Moyobamba.

This tree, known to the natives as *Tumai-Caspi* (rain tree), is about 58 feet in height at full growth, and the diameter of its trunk is about 30 inches. It absorbs and condenses the moisture in the atmosphere with astonishing energy, and it is said that water constantly exudes from its trunk, and falls like rain from its branches. So abundant is the water supply that the soil near by is turned into a marsh. The tree gives forth most water when the rivers are dry during the summer season, and when water generally is scarce. Its cultivation is proposed throughout the arid regions of Peru.

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THE CONCRETOR.

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Extracts of a letter from Mr. C. J. Lewsey, of Cheribon, Java, dated 23rd October, 1877 :—

Messrs. Manlove, Alliott, & Co., Engineers, Nottingham.

Dear Sirs,

You will think it strange that no long relation of the operation with the Patent Concretor has been sent; and were it not for two more orders for the same *fabrikant* you might have been led to entertain a fear that all was not right.

We have had  $2\frac{1}{2}$  months' work, making on an average 90,000 litres per day, the cane juice about  $9^{\circ}$  B, and concentrated by Concretor to  $30^{\circ}$  B, and sometimes upwards.

The quality of sugar is very superior. By simply subsiding the cane juice from the clarifiers, we produce sugar from the vacuum pan fully 2 numbers Dutch grade, superior white equal to 20 (from 19 to 20) and molasses sugar with superior grain, and consequently more sugar.

The working has caused a sensation, and it has been acknowledged by those who have the "triple effect" with the "*Carbonatation*," that *they had much to learn*, their system having been considered the *ne plus ultra*.

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MONTHLY LIST OF PATENTS.

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Communicated by GEORGE DAVIES, C.E., Patent Agent, 4, St. Ann's Square, Manchester.

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ENGLISH.

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APPLICATIONS.

4647. CHARLES DENTON ABEL, Southampton Buildings, Middlesex. *Improvements in the manufacture of lump or loaf sugar, and in apparatus employed therefor.* (Communication.)

4671. JOHN HENRY JOHNSON, 47, Lincoln's Inn Fields, Middlesex. *Improvements in the production of saccharate of lime.* (Communication.)

4672. JOHN HENRY JOHNSON, 47, Lincoln's Inn Fields, Middlesex. *Improvements in the purification and treatment of saccharate of lime, and in the application of the products resulting therefrom.* (Communication.)

## ABRIDGEMENT.

1492. BRISTOW HUNT, of Serle Street, Lincoln's Inn, Middlesex. *Improvements in the treatment of sugar cane, and in apparatus relating thereto.* (A communication from abroad, by Alvaro Francisco Carlos Reynoso, of Paris.) This invention relates to the treatment of sugar cane and sorghum, in order to reduce them into pulp, or preferably into a moist sawdust, and to various operations employed to extract the juice. To reduce the sugar cane and sorghum into sawdust or pulp. Ordinarily, any of the machines or tools employed for the pulverisation of tan and other barks and woods, as well as cone and other mills, various bark-rasping machines, with overlapping saws, or with toothed cutters and ordinary knives combined on the circumference of a drum, or rasps with saws having a reciprocating motion, or the universal crusher or triturator, or other modifications of such apparatus may be employed. Amongst these, however, preference is given to the following forms:—The first apparatus consists essentially in segments of saws, mounted obliquely upon a drum, so that by their continued union they constitute a veritable circular saw, analogous in its effects to the apparatus patented by this inventor on the 28th of April, 1875, No. 1558. The object of separating the saw into segments is to increase economically the diameter of the circular saw, by the combination of the segments, and to facilitate the sharpening of the teeth. The intervening pieces are of iron or fluted steel. A hopper is provided for feeding the material, and a receiver for the pulp or moist sawdust. The second apparatus, which presents two types, consists of the same arrangement of segmental saws, mounted obliquely upon a drum, but these saws are separated from each other by other saws, placed in the direction of the axis of the drum, or inclined thereto. The third apparatus consists also essentially of segments of saws, mounted obliquely on the drum, but having the segments inclined alternately in opposite directions.

1510. WILLIAM KNIBB ILLINGWORTH and WILLIAM WALKINGTON, both of Leeds. *Improvements in the method of, and in apparatus for, cutting loaf sugar.* This machine is constructed with two uprights, to receive a wrought-iron frame, to which are secured, by means of cotters, a series of saws, for the purpose of sawing the sugar into slices, the motion of the frame being actuated by means of a revolving shaft and crank, plate, pulleys, and belt. The sugar is passed through the saws by means of plates, in which are cut recesses for containing the sugar; the plates being fixed to a shaft worked by means of an eccentric. The slices cut out are then deposited on a wire belt, so constructed as to carry them along horizontally through a process consisting of the application of jets of steam to the surfaces of the slices, in order to destroy the dulness created by sawing. The slices are further conducted by the belt and passed between rollers, the surfaces of which are furnished with knives placed at angles with one another, for the purpose of

cutting the slices into pieces ready for use, the shafts of the rollers being received by two uprights; and on the ends of the shafts are wheels and pulleys with belt, causing the shafts to rotate. Suitable receptacles are placed under the rollers for dust and cut sugar.

1902. WILLIAM LLOYD WISE, Chandos Chambers, Adelphi, Middlesex. *A new method of clarifying sugar juice.* (A communication by Doctor Friedrich Loewig, of Silesia, and Gustav Loewig, of Dresden, Saxony.) The inventors have discovered that gelatinous alumina possesses the attribute to purify the sugar juice in so perfect and complete a manner that it is possible after its treatment with the said alumina to proceed at once to crystallization; and sugar juice thus clarified may be exposed to the air for a length of time without suffering any alteration. By their patent No. 1556, April 20th, 1877, they can produce the alumina in such manner and under conditions that there will be no objection to its general adoption in the manufacture of sugar. To clarify the non-purified and non-refined sugar juice or sugar solution, from 1 to  $1\frac{1}{2}$  per cent. of the alumina is added to it, the two are well mixed, and heated slowly to boiling up. The alumina takes up the non-sugar substances so completely that the juice, after separating from the alumina by means of defecation or filtration, will appear perfectly clear, so that crystallization can so far take place that the molasses, if any at all, will appear as a most insignificant quantity.

#### AUSTRIAN.

11. F. & C. FREY, of Visocan. *A process for purifying raw beet juice.*
25. E. MAYER, of Darenic, and C. TÖKEL, of Carolinenthal. *A stone collector for sugar works.*
26. A. MELL, of Prague. *Improvements in extracting the salts from molasses, beet syrup, and beet juice.*
48. E. SIEGL, of Vienna. *Improvements in heating diffusers in sugar works from without.*
60. F. WANNIECK, of Brünn. *Improvements in osmose apparatus for sugar works.*

#### BELGIAN.

43393. H. PRIEW. *Obtaining white sugar of beet pulp.*
43582. C. F. GALLOIS. *A beetroot elevator.*

#### FRENCH.

116813. FARINAUX. *A method of fermentation for sugar or saccharified liquids.*
116853. GUARDIOLA. *Improvements in sugar evaporators.*
116948. BOUSSAUD. *Artificial production of bone black.*
116958. GEISTODT. *Defecating, purifying, and decolouring sugar juice and syrup, molasses, &c.*

117019. D'HENRY. *A chemical called "vaporine," and its use for promoting the boiling of syrup in sugar works, and preventing the boiling over of liquids.*

CERTIFICATES OF ADDITION.

115387. BOUZEL. *Extracting beet juice.*

113520. LEIBERMANN. *Manufacturing sugar.*

GERMAN.

2092. H. PRIEW. *A process and apparatus for claying sugar in centrifugal machines in a hot state.*

3471. A. FESCA. *Claying apparatus in centrifugal machines.*

3685. E. LANGDEN. *Obtaining hard white sugar by means of centrifugal machines.*

AMERICAN.

ABRIDGEMENT.

196595. RANDOLPH. *Improvements in evaporators.* The invention relates to an improved evaporator for molasses, maple syrup, and other purposes, which may also be used conveniently as a feed boiler, it being simple in construction and economical in the consumption of fuel; and it consists of an evaporating pan, extending around the top, sides, and bottom of a sliding fire-box, in which the fire is regulated by a supplementary smoke pipe in front of the main smoke pipe, which passes through a cleansing tub or receptacle, to heat up the liquid therein, preparatory to its being let into the pan.

From press of matter, we have had to defer publication of some of the Patents for last month till our next issue.

SUGAR STATISTICS—GREAT BRITAIN.

TO DECEMBER 15TH, 1877 AND 1876. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

	STOCKS.		IMPORTS.		DELIVERIES.	
	1877.	1876.	1877.	1876.	1877.	1876.
London . . . .	93	.. 47	295	.. 255	260	.. 278
Liverpool ..	32	.. 18	199	.. 179	184	.. 192
Bristol . . . .	3	.. 2	43	.. 77	43	.. 79
Clyde . . . . .	40	.. 20	254	.. 217	232	.. 230
Total ..	168	87	791	728	719	779
Increase..	81		Increase..	37	Decrease..	60

STOCKS OF SUGAR IN THE CHIEF MARKETS OF THE WORLD ON THE  
1ST NOVEMBER FOR THREE YEARS, IN THOUSANDS OF  
TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1877.	TOTAL 1876.	TOTAL 1875.
149	82	6	49	2	288	241	305

CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING  
1ST NOVEMBER, IN THOUSANDS OF TONS.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1877.	TOTAL 1876.	TOTAL 1875.
875	283	29	256	138	1581	1633	1528

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE,  
FOR THE ENSUING SEASON, COMPARED WITH THAT OF THE THREE  
PREVIOUS SEASONS.

(From *Licht's Monthly Circular*.)

	1877-78.	1876-77.	1875-76.	1874-75.
	Tons.	Tons.	Tons.	Tons.
France .....	350,000 ..	243,295 ..	462,259 ..	450,877
Germany (Zollverein) ..	355,000 ..	291,204 ..	346,646 ..	250,708
Austro-Hungary ....	235,000 ..	205,267 ..	180,138 ..	140,192
Russia and Poland ..	250,000 ..	250,000 ..	245,000 ..	222,500
Belgium .....	60,000 ..	44,467 ..	79,796 ..	71,079
Holland and other Countries.....	25,000 ..	25,000 ..	30,000 ..	30,000
Total.....	<u>1,275,000</u>	<u>1,059,233</u>	<u>1,343,839</u>	<u>1,165,356</u>

## STATE AND PROSPECTS OF THE SUGAR MARKET.

The year closes with a further fall during December of from 1s. to 2s. per cwt., fine grocery sugars having experienced the greatest decline ; these latter, however, had maintained a relatively dearer position previously.

Paris loaves are quoted about 1s. 6d. lower.

The stocks of sugar in the United Kingdom, which at the same period last year were only 86,811 tons, were on the 15th December 168,402 tons, showing an excess of 81,591 over the stock on the same date in 1876. The excess of stocks this year over last at the same time was a month previously 55,638, so that during the past month the increase in this direction has amounted to 25,953 tons.

Prices are now very close on those of the early part of 1876, when sugar reached its lowest point, and we fear the present statistical position forbids our expecting any improvement until the low prices themselves, in checking supplies, effect the change panters will need.

Present quotations of the standard qualities are as under:—  
Porto Rico fair to good refining, 21s. to 21s. 6d., against 22s. 6d. to 23s.; good to fine grocery, 22s. to 24s., against 24s. to 27s.; Martinique crystals, 28s. to 29s., against 29s. to 30s.; No. 12 Havana, 22s. 6d. to 23s. against 24s. to 24s. 6d.; fair to good refining Cuba Muscovados, 21s. to 21s. 6d., against 22s. 6d. to 23s.; middling to good brown Bahia, 18s. to 18s. 6d., against 19s. to 19s. 6d.; good to fine Pernambuco, 19s. to 20s., against 20s. to 20s. 6d.; Paris loaves, f.o.b., 28s. to 28s. 6d., against 29s. 6d. to 30s.

# THE SUGAR CANE.


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No. 103.

FEBRUARY 1, 1878.

VOL. X.

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 The writers alone are responsible for their statements.

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*For Table of Contents, see opposite the last page of each Number.*

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## THE MINUTES OF THE PARIS CONFERENCES.

### IV.

#### SURTAXES.

At the sixth Conference an interesting discussion on surtaxes commenced. M. Rahusen, the first Dutch Delegate, objected to the pretensions advanced by the French at the Conferences of the preceding year. They had then suddenly started the idea that it was not sufficient to equalize the conditions of competition between the sugar industries of the four contracting countries by the mutual suppression of the bounties which their raw and refined sugars might enjoy in their respective territories, but that, in addition, access to their markets of sugars coming from third countries, the legislation of which granted bounties on exportation, should be resisted by means of surtaxes. Such an obligation, he contended, could not be imposed upon the four contracting countries. It was a course which would be interdicted by treaties of commerce in the case of those States which received the treatment of the most favoured nation. It would also be a violation of the principles which governed the policy of the cabinet of the Hague. Public opinion in the Netherlands is so completely in favour of free trade that the question of surtaxes could not even become a subject of discussion, and the States General would probably reject any arrangement which imposed such an obligation upon Holland. He suggested that a general abolition of surtaxes



would be a better means of attaining the end in view, coupled with an attempt to influence by united action those foreign States which gave bounties to their sugar industries. Each of the contracting States would, of course, retain the power to establish surtaxes if it thought proper. The importance of the competition of countries outside the Convention had, he thought, been much exaggerated. The only important bounties, those granted to the Austrian industry, had recently been reduced from 65 to 70 per cent. To take measures against States outside the sugar union would, he considered, be going beyond the object of the Convention.

The French Delegates argued, in reply, that the French Government, which is disposed to suppress those bounties which may still exist in France, must at the same time consider the competition to which French produce may be exposed. On the one hand it is desirable, in the interest of the indigenous sugar industry, that France should impose surtaxes on bounty-fed sugars imported from third countries. "For, the indigenous production amounting "to about 500,000 tons per annum, with an interior consumption "of 300,000 tons at the most, it is essential that bounty-fed raw "sugars coming from foreign countries should not restrict the "natural demand for it by entering into competition with it even "on French territory." On the other hand, the French refiners should be assured that their foreign competitors in the sugar union are not placed in a privileged position by being enabled to use bounty-fed raw sugars.

We will pause here for a moment, to point out the transparent fallacy of this argument, of which we have taken care to quote, above, M. Ozenne's exact words. In the case of loaf sugar manufacture in England, it is a positive fact that every refinery but one or two has ceased to produce such sugar, on account of the heavy bounty given to loaf sugar on its exportation from France. Here is a case in which the British industry has been supplanted by the bounty-fed French industry; and it has been argued, as we believe with strictly logical accuracy, that it would be perfectly consistent with free-trade principles, and, in fact, the only way of maintaining free trade in loaf sugar strictly and theoretically speaking, to

counterbalance the bounty, which enables such sugar to be sold below cost price, by charging an equivalent duty on sugar receiving the bounty. Only by such means can the natural sources of production be maintained, and the consumer defended against an artificial monopoly. But in the case stated by M. Ozenne, the facts are exactly the reverse; and these facts, which he is so careful to state, are sufficient to dispose of his argument. He says that the French indigenous production amounts to 500,000 tons, while the consumption of the country barely comes up to 300,000. It is, in fact, under 250,000 tons. Hence it is manifest that some of the home-grown sugar must be exported, and that, therefore, the price of raw sugar inside France must be on a level with the price outside. Of what avail, then, can it be to put a surtax on Austrian raw sugars, since French raw sugars are being sold at the same price? Again, M. Ozenne says that French refiners must be assured that their foreign competitors are not placed in a privileged position, by being enabled to use the bounty-fed sugars of Austria. How can this ever be, so long as the surplus production of French raw sugar is flowing over into all the sugar markets of Europe, and is consequently sold there at the market price of the day? Under such circumstances, no amount of surtax on Austrian sugars, whether levied in France or England, could affect the value of raw sugar in either of those countries. This was pointed out by Mr. Walpole at the close of the discussion.

The Belgian Delegate next stated his opinion. In the case of countries to which the treatment of the most favoured nation had been secured by treaty, he did not consider that it would be contrary to such an engagement to surtax sugar coming from those countries if they should have altered the situation, and granted, by change of legislation, special favours to their sugar industry since the conclusion of their treaties of commerce. He pointed out that the cost of transport alone would be sufficient to keep Austrian sugars at a distance from France. For the last three years, also, there had been a constant and marked tendency towards the reduction of the Austrian bounties. In 1874, for the collection of duty, the Austro-Hungarian fiscal authorities only calculated the

charge for duty at 178 kilos. of roots per diffuser; in 1875, this average was raised to 222 kilos.; and in 1876 to 390 kilos.\* The augmentation had therefore been more than 100 per cent. in three years. If, therefore, the Austrian bounties have not yet injured French refining, there would be less and less chance that they would do so in the future. Belgium would certainly not consider herself authorised to surtax Austrian sugars at a time when the Austro-Hungarian Government was reducing the bounties in such considerable proportions.

The subject was resumed at the Ninth Conference, when the Belgian Delegate stated that his Government deprecated the introduction of any clause relating to surtaxes, on the ground that it might complicate negotiations about to be commenced for the renewal of the Treaties of Commerce. He hoped, therefore, that the French Government would not insist on the insertion of such an Article. The Dutch Delegate announced that his instructions debarred him from consenting to the establishment of surtaxes. He could only admit the reproduction of a clause analagous to Article XIX. of the old treaty, recognizing a simple faculty without imposing any obligation. He considered the question exhausted, and proposed, as a compromise, that the Contracting Parties should simply reserve to themselves to concert together as to the means of obtaining the adhesion of other countries to the disposition of the present Convention. Mr. Walpole announced that the British Government would not consent to any stipulation of the nature of Article XIX. of the Convention of 1864, if it had any other effect than the recognition of a simple faculty for each State.

At the Fourteenth Conference the French Delegates presented a draft treaty which concluded with the following Article:—

“In the event of bounties, direct or indirect, being granted by  
“other countries on the exportation of raw or refined sugar, and  
“becoming compromising to the production of one or other of the  
“High Contracting Parties, a new understanding would be pro-  
“moted in order to consider in concert as to the measures of  
“defence which might be taken.”

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\* The amount has again been raised.

This was warmly discussed at the following Conferences, and threatened, at one moment, to bring the negotiations to an untimely end. The Dutch demanded the suppression of the words "measures of defence," and renewed their declarations that their Government considered that the Article should carry no obligation to establish surtaxes, or even to promote an agreement with that view. Mr. Walpole suggested the substitution of the words:—

"May come to an understanding, in order to consider the "measures to be taken."

This alteration was provisionally accepted, but, at the following Conference, was rejected by the Minister of Commerce, who insisted on maintaining the original text. Mr. Walpole stated that, as he had already communicated the amended text to his Government, he could not accept the proposed change without further orders.

At the Seventeenth Conference he declared that it was impossible for the English Delegates to accept the Article in its present form. They had only consented, in a spirit of conciliation, to the adoption of the clause, re-cast in the manner he had pointed out at the last Conference but one. Eventually Mr. Walpole's version was accepted, and the discussion of the subject was finally closed.

#### THE FRENCH SUGAR DUTIES IN 1877.

It appears from the *Journal Officiel* of the 15th January, that the revenue from sugar for the year 1877 compares as follows with the budget estimates, and with the receipts for 1876:—

	1877. Receipts.	1877. Estimates.	1876. Receipts.
	Francs.	Francs.	Francs.
Colonial Sugar .....	33,843,800	39,262,000	31,273,000
Foreign Sugar.....	43,210,000	24,897,000	30,667,000
Indigenous Sugar ....	85,178,000	122,842,000	123,099,000
Totals .....	162,231,800	187,001,000	185,039,000

This gives a deficiency of 24,769,200 francs on the budget estimates, and of 22,807,200 francs on the receipts of 1876.

Although this may partly be explained by a falling off in the consumption owing to the high prices ruling during a portion of the past year, it is probably still more to be attributed to the greater skill which another year's practice has given to the refiners in manipulating to their advantage the new system of assessment.

On referring to the quantities of the various classes entered for temporary admission (*i.e.*, exportation after refining) during the past year, it will be found that the quantities assessed as fourth or lowest class compare as follows with the quantities assessed under the old system :—

*Sugars of the 4th Class (below No. 7) entered for temporary admission.*

	1877.		1875.
	Kilos.		Kilos.
Indigenous.....	19,580,823	.....	5,959,670
Colonial .....	7,736,235	.....	2,971,096
Foreign .....	6,713,617	.....	1,037,957
	<u>34,030,675</u>		<u>9,968,723</u>

Under the old system of assessment by colour, the point of the scale where the refiner derived most benefit was at No. 9, by getting sugar assessed as only yielding 80 which really yielded 90. Under the new system of assessment by analysis, the point of greatest advantage is no longer the turning point between second and third class, but that between the third and fourth. There are three reasons for this. The difference between a yield of 67 and one of 80 offers a greater temptation than that between 80 and 88. Under the colour system very little sugar could be got below No. 7, but under the analysis system plenty of sugar can be found which appears, under the erroneous French system of analysis, to yield less than 76, and is therefore classed as yielding only 67. Even if the sugar yield only 76, there is still an export bounty to the refiner of 9 per cent. But, in point of fact, a sugar which appears, by the French system of analysis, to yield only 76, really

yields considerably above 80; and therefore it may safely be said that all the sugar entered for temporary admission as fourth class leaves a bounty to the refiner of from 15 to 20 per cent. No wonder, then, that the quantity has been nearly quadrupled since 1875.

The new processes for the purification of the lower classes of sugar now give a further incentive to the use of such sugars by the Paris refiners, and thus facilitate their securing the enormous bounty obtained from them—a bounty which is constantly increased as those processes are brought to greater perfection. These facts show that the British refiners did wisely in resisting all efforts to conclude a treaty on so fallacious a basis as that of French saccharimetry.

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#### THE COLOURED-SUGAR QUESTION IN AMERICA.

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A Baltimore paper gives some details respecting the recent seizures of coloured Demerara sugars in United States ports. In a memorandum addressed to the United States Consul at Demerara it is stated that the dark colour of the suspected sugars is owing to the absence of the chemicals usually employed in purifying the cane juice. This does not quite tally with the explanations recently offered, that the dark colour was caused by the impurities which are usually removed being allowed to remain in the juice, thereby blackening the sugar made from it.

We give the following extracts from the Baltimore paper:—

“E. C. Chamberlain, special agent of the Treasury at Baltimore, on Saturday, notified Collector Thomas and United States District Attorney Stirling that he had seized certain Demerara sugars, believing them to be artificially coloured by the introduction of colouring matter, in order to defraud the revenue. The seizure was made under instructions from the Secretary of the Treasury. The secretary’s order was dated Nov. 28, and authorised the seizure, in accordance with the statements and alleged evidences of fraud which Chamberlain had laid before the department, after first submitting his data to the district attorney, as required, in due form.

The sugar seized was 749 bags imported by Wm. H. Perot by the brig Mississippi, Nov. 26, and 965 bags and 69 hogsheads imported by Tate, Muller, & Co. by the barque Manitou, Nov. 24. The issue between the Government and the importers of Demerara sugars, which Mr. Chamberlain has been tireless in his efforts to bring about, has now been joined. The question goes to the United States courts, where the burden of proof will rest with the prosecutors. Mr. Stirling proposes to push the suit to an early trial. Collector Thomas, although the chief customs officer at Baltimore, in this instance becomes the custodian of the sugars pending the suits, and receives his instructions from the special agent.

“The seizures did not create much stir among the sugar importers, who had become heartily tired of the shifting policy they have had to endure for several months past. Several weeks ago it was understood that Secretary Sherman was satisfied the sugars were regular, but in a day or two afterwards reflections upon the importers were again circulated.

“Colonel Philip Figyelmesey, consul of the United States in British Guiana, who is now in this country, came a passenger in one of Mr. Perot's vessels, the only regular packet line, and, in this, those opposing the importers see collusion between the consul and the importer. The State Department on September 6th despatched to Col. Figyelmesey at Demerara to make an investigation of the sugar, and it is alleged he telegraphed his reply the next day, but sent Mr. Perot a copy before it reached the department. This Mr. Perot pronounces untrue, and says the first he knew of the matter was September 29, three weeks after, when the intelligence was brought by a sailing vessel to Baltimore. At that time he received copies of a pamphlet published by the Demerara planters, as follows :

“We, the undersigned, owners, attorneys, and managers of sugar plantations in the colony of British Guiana, having been requested by Col. Philip Figyelmesey, Consul of the United States of America, to state whether, to our knowledge, the dark centrifugal sugars manufactured in this colony have been coloured by artificial means, do hereby most solemnly declare that no colouring

matter of any kind is introduced in the manufacture of the said sugars, and that the dark colour is the result of the absence of the chemicals usually employed in purifying the cane juice, which are not used in the manufacture of these dark sugars, as any proper analysis will prove.'

"The Baltimore sugar dealers of all classes are on the side of the importer in the issue raised. They look upon it as especially unfortunate for the sugar business of the port, which is crippled already. Demerara is, after Rio, the largest importer of our products. Pending this litigation of course the business between Baltimore and that colony will be paralyzed."

"The United States district attorney, Archibald Stirling, jun., is preparing the information by which proceedings will be commenced in the United States Court for forfeiture of Demerara sugar seized by special agent, E. C. Chamberlain, Saturday, on the alleged ground that the sugars are artificially coloured by the introduction of colouring matter to secure their importation under a lower customs rate. Collector Thomas was at Washington yesterday in connection with the matter, and the special agent also went over on same business. Mr. James, of the Treasury Department, has notified the Baltimore importers that a partial promise made by the Secretary Sherman some time since, that Demerara sugar might be exported hence, if the importers declined to submit to the exactions of the Government, was now withdrawn.

"The Baltimore sugar market was dull yesterday, as most of the stock now here was under the ban of seizure. The action of the customs authorities at New York in refusing to seize Demerara sugars, but leaving the merchants to have a fair opportunity to explain the process by which it is manufactured, is looked upon in Baltimore as the proper method, especially at this period, when trade should be fostered rather than proscribed. The whole question, it is believed, will ultimately result in good, by attracting public attention to the needs for revenue reform and a uniform system of levying duties, which cannot be constructed. It is understood that Mr. Thomas does not believe that Demerara sugar is artificially coloured."



We also extract the following from a Demerara paper of December 25th:—

“The local produce market is practically suspended. The seizure at Baltimore by order of the United States Custom House authorities of two cargoes of “dark centrifugals” exported by Messrs. Perot & Co., operates as an effectual barrier to further shipments for the American market. The consequence is that almost the whole of the crop is being shipped to the United Kingdom (where stocks are so rapidly accumulating) with the probable effect of still further depressing prices.”

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### LOSS OF REVENUE IN THE UNITED STATES.

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The following paragraph from the *Economist* is interesting when read in connection with the now nearly exploded export bounty on sugar and the recent sinister reports as to irregularities in the collection of the sugar duty. That “one-fourth of the revenues of the United States are annually lost in the collection” is not so surprising, if all departments of the customs lose as much as that devoted to sugar has been in the habit of doing.

From the sixth Report of the Commission on the New York Custom-house, some instructive statements are made. New York, it may be pointed out, is by far the most important centre of the foreign trade of America. The total imports in 1876 were £95,340,000, and the exports, £133,250,000; New York alone importing, out of the total amount, as much as £62,350,000, and exporting £61,700,000, thus taking to itself about 55 per cent. of the entire foreign trade of the United States, and far outstripping any other port in the country. The report is to the Secretary of the Treasury, and in accordance with his request that “in regard to complaints received by the Commission respecting the customs revenue laws, and made with a view to their revision and improvement, you will please report such suggestions tending to this end as may, after careful investigation, meet with your united approval.” The Commission reply by quoting the

conclusions come to by the New York Chamber of Commerce Committee, thus:—"In many cases the evils complained of are "distinctly due to the complex character of the tariff, with "specific duties, *ad valorem* rates, and the two combined. In "others they appear to come from the regulations of the service "established by Congress or the Treasury Department, and in "others, again, from the uncertainty touching the classification of "goods and rates of duties. In a large number of cases, however, "the difficulty, whatever its origin, has been exposed to aggra- "vation by incompetency, indifference, and yet graver faults or "irregularities in the administration of the service." And in making suggestions for the needful reform, the Commission recommend that the competitive examinations for the Civil Service, as adopted in England and France, should be introduced into America. Referring to the yearly loss of customs revenue, which they fear is under the existing bad system of administration an increasing loss, the Commission recall the statement that "one- "fourth of the revenues of the United States are annually lost in "the collection," considering that estimate as "sufficiently "startling," although, much below what is sometimes estimated. "The receipts," say the Commission, "from customs in 1874, for "instance, were \$163,103,833; the one-fourth lost would be "\$54,000,000; and the total amount which we should have "received would have been \$217,000,000." The want of integrity among collectors of revenue may, or not, be in large part a cause of this loss, and we here have no claim to criticise the manner in which the American people set their house in order; but what we have a direct right to ask is, Why not abolish duties where possible and simplify the rest? With a working population pauperised by depressed trade, with taxes upon imported articles of the most ordinary necessity, with a reduced carrying trade, with scandals in the revenue service, and an outcry from honest traders that that service is a cover for dishonesty, it ought to be apparent to nearly all sections of the people that the system of complicated customs duties existing in the United States should be not so much reformed as abolished.

## THE ECONOMIC EFFECTS OF FOREIGN PROTECTION ON BRITISH FREE TRADE.

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We may safely say that no policy was ever evolved from out of so fiery a crucible of discussion as that of British free trade. Unless the British ministers who supported free trade and ultimately secured its triumph over protection had felt that its principles were unassailable, it would have been impossible for them to have devoted themselves to carrying measures, the immediate effect of which was to inflict misery and ruin upon some of the then leading sections of our industrial community. Sound indeed must be the principles to sustain a Government in passing measures for the general good to the specific detriment of the few. But statesmen are not necessarily the originators of the doctrines to which they give legislative effect. It is to the economists that the nation is really indebted for its free trade. Well might Cobden lament as an obstacle in his path that there were so few heads which could understand an economic problem. Speaking before the House of Commons in 1846, Cobden thus alludes to his difficulty of advancing free trade as follows:—"I know that there are many heads which cannot comprehend and master a proposition in political economy. I believe that that study is the highest exercise for the human mind, and that the exact sciences require by no means so hard an effort." That Cobden did truly appreciate the labours of the economist is well placed on record in the interesting despatch which was received from Mons. Drouyn de Lhuys on behalf of the French Government after Cobden's death in 1865. "Certainly," writes the French minister, "Cobden did not create any of the principles of industrial and commercial liberty. They had been professed and propagated before him by eminent theorists in England and France, but his glory is to have followed up the practical application of them beyond as well as within, with an ardour and devotedness unparalleled." We have felt it necessary thus to remind our readers that the true principles of free trade, in other words of international commerce, had better be studied first hand in the works of such writers as

Adam Smith, Ricardo, MacCulloch, John Stuart Mill, Fawcett, and the late lamented Professor Cairnes, rather than that they should be guided in their judgment by a host of unsound writers who either advocate or oppose free trade by a fluent use of what Lord Derby terms its "rant and cant," or by an unintelligent handling of the statistics of commerce. At the present time England, France, and Europe generally as well as America, are suffering from great commercial depression. Thereupon innumerable writers of the kind we have alluded to would persuade us that the cause lies in our free trade policy, whilst other writers of a like kind take upon themselves the championship of free trade in reliance upon popular maxims which are more easily controverted than proved. Now the problem which puzzles many is that which is generally referred to as "unreciprocated free trade." We would endeavour to apply some of the principles of the economists by an economic investigation of the effects of foreign protection on English free trade. Foreign protection may operate in three ways, viz., by hostile tariffs, by bounties on production, and by bounties on exportation. Now, taking the latest and what we conceive to be the most satisfactory view of the principles which govern international trade, we would regard them as of a like kind to those which govern the interchange of commodities in one and the same State. In other words, we would adopt Professor Cairnes' view, that international trade is a mere development of that principle of division of labour which originates the necessity of the exchange of commodities, and that the real distinction between international and domestic trade lies in the greater influence exerted over the former by geographical and national causes. It is obvious that the true theory of free trade requires that the whole area of production and distribution should be considered as one, so that full effect may be given to that division of labour which shall realise to the utmost the advantages possessed by different localities in respect of soil, climate, &c. In accordance with this theory England has been willing to allow her industries and commerce to settle at their proper or natural level in unrestricted competition with the whole world, but foreign nations have not ventured to cast in their lot with ours. Consequently, we find any

special advantages we may possess lessened or neutralised by hostile tariffs or equalised or supplanted by foreign bounties.

Both in the home and in the foreign market, notwithstanding our free trade policy, we are made to feel keenly the hostile influence of foreign protection. But we should suffer still more if we were to abandon our own free trade policy. To whatever degree foreign nations obstruct our imports by hostile tariffs, to the same degree they restrict our purchasing power over their exports. Supposing English goods were absolutely prohibited from entering any given country, it is plain that our power to obtain what we required from that country would be restricted by the necessity of our paying gold for their exports to this country. Thus, instead of our resources of labour and capital being employed to the best advantage in the production of commodities which would command in exchange the greatest quantity of foreign commodities, we should be compelled to occupy so much of our labour and capital less advantageously either in the production at home of that which we could at less cost have obtained from abroad, or else in the production of commodities suitable for export to the gold countries. If instead of hostile tariffs, our free trade comes in contact with bounties on production, and bounties on exportation, we suffer again by the arbitrary diversion of a greater or a less portion of our labour and capital from those natural channels which would be otherwise taken. In short, we are compelled to admit that if foreign nations refuse to deal with us on principles of free trade, we do not, and cannot realise the full benefit of free trade, because we are hindered by such foreign protection from giving full effect to that sub-division of our labour and capital which would result in lessened cost of production and consequent increase of our purchasing power, and so of our material wealth. There is no doubt that sooner or later protection will break by its own weight, and possibly we shall suffer most in the era which precedes its final downfall. Whether we are entering upon that era now it would be difficult to say. Statesmen cannot always give effect to economic truths or hold the scales of the State so evenly as to prevent one class benefiting at the expense of another. The stability of the English constitution has enabled our ministers to

carry measures which foreign governments would hardly dare to propose. What French Government will dare to remove the artificial support which maintains its sugar industry? \* We fully recognise the adverse influence upon our trade and industry of foreign protection, and we believe that our only mode of meeting the attack of protectionism is to ignore it and to use our utmost efforts to find in new fields of enterprise that development of our resources which is denied us in the present constituted area of production. We ought to have a Minister of Trade and Commerce, whose duty it should be to take cognizance of all that bears upon our commercial prosperity, and who should be the means of obtaining for our commerce due recognition in the Legislature. Within the realms of free trade the interests of the consumer are akin to those of the producer, and the legitimate assistance which the State might, by the appointment of such a special Minister, be enabled to render to producers, would not be antagonistic to consumers, but would be a national benefit. Moreover, political economy should be more generally studied, so that the true import of commercial statistics may be made apparent.—*The British Trade Journal*.

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### BARBADOS.

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Captain Strachan, who was appointed to succeed Mr. Pope Hennessy, as Governor and Commander-in-Chief of the Windward Islands in 1876, opened the Legislative Sessions in Barbados, on the 12th December, 1877, and communicated to the members of the two legislative bodies, the following dispatch:—

Downing Street, 16th November, 1877.

Sir,

The time being now near at hand when, on your return to Barbados, the Legislature will be summoned to meet for the dispatch of business, it is

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\* The only mode of dealing with foreign bounties is to intercept them for the English taxpayers by equivalent duties, and thus release our free trade markets from the influence of such form of protection. This course has been demonstrated as not only consistent with, but logically necessitated by, our theory of Free Trade, by Mr. W. P. B. Shephard and Mr. Nevile Lubbock, in published pamphlets.—*Ed. S. C.*

desirable that I should address you on some subjects respecting which there is, as I am aware, considerable anxiety to learn the views of Her Majesty's Government.

2. Having carefully weighed the inconvenience and advantage attendant upon a temporary suspension of legislation, I deemed it advisable that I should have an opportunity of conferring with you on the affairs of Barbados, and that the sittings of the Legislature should not commence until you could open the chambers in person, with an announcement of the course which I think it desirable to pursue.

3. A great pressure of business prevented me during the earlier part of the autumn from conferring with you, but, though regretting the delay in the re-assembling of the Legislature which has thus arisen, I have been strongly impressed with the belief that [after recent occurrences there would be distinct benefit in an interval, during which the strong feelings which had unfortunately been aroused might be allowed to subside.

4. I will therefore at once address myself to that question, which is of the deepest interest to the Legislature and the people of Barbados, and is no less one which has weighed much with me. Having regard to the past history and present condition of the island, and to the fact that, the emancipation of the slaves placed the various classes of the community in relations to each other different from those which existed when the present constitution was granted to the colony, I have been called upon to consider whether it is now possible to maintain in existence the old constitution of the island. That constitution possesses features which, however interesting as having been handed down from a remote period, are in some respects inconsistent with the principles on which it is now demanded that the subjects of Her Majesty in every part of the world should be governed. The late unhappy disturbances have, as all persons interested in the island are aware, further attracted public attention very strongly to the question, whether the constitution of Barbados requires amendment, either by extending the franchise, or by establishing that direct protection, by the Crown, of the unrepresented classes, which takes the place of representation, and which is afforded by the constitution of a Crown Colony.

5. Though in no way disregarding the interests and claims of the large negro population, I cannot on the one hand entertain the idea of any such extension of the franchise among them as could materially affect the present composition of the Assembly ;—nor on the other hand am I, after mature reflection, now prepared to invite either the local legislature or the Imperial Parliament to transform Barbados into a Crown Colony. I cannot but feel some regard for that old constitution which, in the hands of intelligent and frequently distinguished men, has been, with all its defects, during a long period the means of affording good government to the people of the island.

There have been, and are still, grave deficiencies in some of the public institutions of the island. They have not kept pace with those changes which the advance of public feeling has rightly enforced both in this country and in other parts of Her Majesty's dominions. But I should not be doing justice to those who have administered a constitution conferring singularly independent powers upon a small minority of the people, if I did not recognise the fact, that whatever may have been the practical defects of administration, the poorest classes have retained a remarkable affection for their country, and the universal loyalty of the islanders has become proverbial.

6. While therefore it is hardly necessary for me to observe, that to create a constitution such as that of Barbados, would be impossible at the present day, there are strong reasons why I should hesitate to recommend, and why I should try any other reasonable course before recommending the abolition or even a radical alteration of the existing constitution, and I need not say that it is much more in accordance with my own views and wishes to rely, as I feel that I ought to be able to rely, upon the strong assurances which I have received, that the Assembly will be prepared to co-operate loyally with the Governor, and with Her Majesty's Government, in carrying out such measures as involve the well-being and happiness of the people, more especially of the poor and infirm, in removing defects in constitutional practice, and in amending the condition of those public institutions, which are still in need of material improvement; and if this co-operation is loyally and cheerfully given, I see no reason why it should not be possible for Barbados to maintain her present form of government.

7. I have instructed you personally to report to me, after further residence in the colony, upon the social condition of the labouring classes; I will therefore pass at once to some points of general administration, as to which I feel it necessary that a better system should be adopted.

8. I must, in the first place, call your serious attention to the procedure in Barbados as regards financial matters, which is defective and unsound. It is neither in practice nor in principle essential to the maintenance of the existing form of Constitution, and I cannot doubt that the Assembly will readily agree to adopt such resolutions or enactments as may be necessary, in order to introduce a system more in accordance with the universal practice. In Barbados there are not, as elsewhere, estimates of revenue and expenditure prepared by the Government, and submitted on the responsibility of the Government to the Assembly; while there exists the anomalous practice of expending the public money through Committees or Boards, composed of members of the Legislature.

9. Desirous, however, as I am, of meeting, as far as possible, the wishes of the Assembly, I do not propose that the direct and active supervision of



expenditure by members of the Assembly should, under the peculiar circumstances of the island, be in all cases abolished. But I would propose that, either by altering the constitution of the Consolidated Board, or by substituting for it some similar arrangement, provision should be made for associating the members of the Executive Council (and the Colonial Engineer as a consulting member) with a suitable number—which might be not less than three nor more than five—of members of the Assembly, as a Board of Direction, for carrying out the more costly public works; those, for instance, the estimated cost of which may exceed £1000.

10. I request, therefore, that you will invite the Assembly to concur in the proposal that, as in other colonies, annual estimates of revenue and expenditure shall be prepared, by the Government, and submitted for the consideration of the Assembly; and further to take steps for securing such supervision of expenditure, of the nature, and to the extent, which I have proposed.

11. I should not object, although it is unusual, to leave, to such a Board as I have referred to, the duty of originating any proposals for additional taxation, or other provision required to meet a deficit on the expenditure sanctioned by the House; but it would still be in the power of the House either to reject or amend such proposals.

12. It is, in the next place, of pressing importance that provision should be made for the presence in the Assembly (as in all other important colonies) of one or more of the principal officers of the Government. Up to a recent date this requirement has been more or less adequately provided for by the willingness of a constituency to return a Government officer. But it is obvious (even without reference to recent experience) that in a small island, in which the constituencies do not represent the various interests which exist in the colony, any divergence of opinion between the Government and those controlling the representation, may lead to the Government being without a voice in the Elective Chamber. There is then no opportunity for those explanations and mutual understandings which are absolutely essential to the conduct of public business, and the communications between the Assembly and the Executive Government can only be carried on by means of Messages between the Governor and Speaker, a practice which entails alike upon the representative of the Crown, and upon the chamber, inconvenient and often lengthy communications; and thus engenders many cases of difficulty and misunderstanding. To remedy this serious defect, I request you to invite the Assembly to pass an Act declaring that any two of the salaried officers of the Government shall be entitled to sit and speak in the Assembly, notwithstanding that they may not have been elected by constituencies. This is in accordance with the practice

which prevailed at the Cape of Good Hope, until the introduction of responsible government. It is my opinion that the Assembly in giving seats to these officers, should also give them votes; but as their voting power would be practically of no material force, the question is one which I am content to leave to the Assembly. Whilst on this subject, I cannot but observe that the long intervals which elapse between the sittings of the House, which, as I understand, take place on an average once a fortnight, must seriously impede useful legislation, and I would suggest, more especially with reference to those weighty measures which will occupy the attention of the House in connection with poor relief, provision for the insane, education, and other matters, not less important, that the sittings of the House should be more frequent, and that when the public business will admit of it, there should be a recess during such season of the year, as may be most convenient to the Legislature.

13. The last point to which I will at present address myself is the necessity, which appears to me urgent, of making provision for the systematic, careful, and frequent inspection of the Hospitals, Asylums, Alms Houses, and other public Institutions by a Government Inspector, who should report monthly, or if circumstances require, more frequently, to the Governor, on the condition of these institutions and their inmates. I do not think it necessary to express an opinion as to the precise provision to be made for this purpose; these are details on which, with the local experience at command, there ought to be no difficulty in arriving at a satisfactory conclusion, and it will be for you to consider what proposal you should make.

14. I have now briefly, and necessarily in very general terms, explained the policy which in my opinion ought to suffice, if Her Majesty's Government is cordially and energetically assisted by the Colonial Legislature, to meet the more pressing requirements of Barbados. In these proposals I am confident that the Assembly will read and appreciate my desire to avoid any interference with the constitution; my wish that they should undertake those reforms which every Government of every country must, under the changing circumstances of political life, accept and carry out, if they would not see public institutions languish and become useless from the inevitable growth of abuses, or from a nonconformity with the new wants and conditions of their age; and my anxiety to deal with them and their interests in a friendly and considerate spirit. If they, on their part, show themselves ready to meet Her Majesty's Government in a similar spirit, I have little doubt that the questions which occupy our common attention may be settled in a manner to satisfy public interests in Barbados, no less than public opinion in England.

15. I can hardly doubt that the reforms of which I have indicated the general scope will be considered reasonable, and it will rest with the Assembly,

to show whether I am justified in the hope that the existing constitution of Barbados may be made to meet the requirements of the community, and the necessity for any extensive modifications of it may be averted.

I have the honour to be, Sir,

Your most obedient humble Servant,

(Signed.)

CARNARVON.

Governor STRACHAN, C.M.G.,  
&c., &c., &c.

We understand that a telegram has been received in London, to the effect that the Assembly have rejected the proposal for Government nominees to sit in the House. This being so, it is to be hoped, that the other measures which the Government regard as essential for the well-being of Barbados, may meet with the approval of the House of Assembly, and be promptly legislated upon. It is not within our power now to criticise the course adopted by the representative Assembly. We have always regarded the presence of crown nominees in a representative assembly as an anomaly quite inconsistent with the ordinary principles of representative legislation. But as a matter of policy, it seemed to us, that the House of Assembly might, without danger to their constitutional privileges, allow a representative of the Crown to take his seat in their House, provided that he was expressly excluded from voting, and furthermore that the license was one of limited duration, requiring renewal by the Assembly after a fixed time. We cannot help noticing that Lord Carnarvon's despatch is one which betrays a kindly feeling towards Barbados. It intimates, however, in a most clear and straight forward manner that unless the colony meets the wishes of Her Majesty's Government in certain matters of local reform, the Imperial Parliament will be called upon to intervene with its paramount authority. Now no statesman or constitutional lawyer will deny the supreme authority of Parliament. At the same time, parliamentary usage shows that very exceptional circumstances are expected by Parliament to be placed on record, before an Act is passed of direct legislation for a colony.

Lord Glenelg, when Secretary of State for the Colonies, in a despatch, thus indicated the limits of Parliamentary inter-

vention:—"Parliamentary legislation, on any subject, of exclusively internal concern to any British colony possessing a representative assembly, is, as a general rule, unconstitutional. It is a right of which, the exercise is reserved for extreme cases, in which necessity at once creates and justifies the exception."\* In a subsequent portion of the same despatch, Lord Genelg intimates, that the exercise of the supreme power of Parliament ought not to be called for, by the advisers of the Crown, upon a question, or, in a constitutional conflict of opinion, which involved no urgent danger to the peace of society, and presented no insuperable impediment to the ordinary administration of public affairs. To paraphrase therefore a now famous expression, we might safely say that "the greatest of Barbadian interests is peace."

We venture to think that all Barbadians who love their old constitution will take such good heed to public affairs as, with the dignified support of the local press, shall prevent the least approach to those exceptional circumstances which alone would justify an appeal to the Imperial Parliament to interpose its paramount authority, and over-ride the will of the colony.

W. P. B. S.

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During recent years the sugar cane growers of the French and other West India Islands, Cuba included, and also those of Louisiana, are making the cow pea a feature of their cultivation. The article is used for feed and for manure, but mostly the latter. It is a low-growing plant, making, on stiffish, and rather rich soil, a dense growth. As land is run down, or cane becomes sick of it, this pea crop is allowed the whole of the soil. It is ploughed in, and so enriches the land that two or three full crops of cane can be grown after it.

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\* The doctrine laid down in this passage is quoted with approval as an authority by Sir T. Erskine May, in his latest work on "Parliamentary Practice." With the exception of the Act suspending the constitution of Canada, at the time of the rebellion, and an Act suspending the constitution of Jamaica, in consequence of the Assembly withholding supplies and neglecting their function, we believe that every Act of Parliament dealing with the constitution of a colony recites the previous assent of the local legislature.—W. P. B. S.

TRAITÉ THÉORIQUE ET PRATIQUE DE LA FABRICATION DU SUCRE, COMPRENANT LA CULTURE DES PLANTES SACCHARINES, L'EXTRACTION DU SUCRE BRUT, LE RAFFINAGE, &c.

PAR DR. E. J. MAUMENÉ.

*Continued from page 623.*

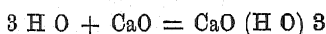
Fleury, by means of syrup of violettes, found lime present in a very fine sugar. The syrup of violettes, when prepared with this sugar, lost in a few hours its fine blue colour, and became greenish brown. Daniell gives a composition of

Sugar	...	...	...	...	...	...	33.2
Lime	...	...	...	...	...	.....	16.5
Water	...	...	...	...	...	...	50.3
							100.0

But this, although agreeing with the results got by Ramsay, is not a true compound. It was Peligot, in 1838, who gave for the first time an analyses of a sucrate of lime. This sucrate "obtained by putting slaked lime in contact with an aqueous solution of sugar," gave off heat, and always contained 14 per cent. of base, corresponding to  $C_{12}H_{11}O_{11}$ ,  $CaO$ . It is a colourless, brittle, and resinous body. Soubeiran, employing milk of lime, obtained more reliable results. He acted "on a solution of cane sugar by an excess of milk of lime," filtered, and dried at  $100^{\circ}$ , in a current of air free from  $CO_2$ . The product resembled the sucrate of Peligot in appearance, but contained more lime. In place of  $C_{12}H_{11}O_{11}$ ,  $CaO$  or  $C_{24}H_{22}O_{22}(CaO)_2$ , Soubeiran found  $C_{24}H_{22}O_{22}(CaO)^3$ , and, considering the former sucrate as bicalcic, called the new body tricalcic. Soon after, a quadricalcic was made known by Peligot,  $C_{24}H_{22}O_{22}(CaO)_4$  or  $CaO = 24.6$  per cent. Bovin and Loiseau have since obtained this sucrate, the quadricalcic, by saturating a solution containing a  $\frac{1}{10}$  of sugar with a sexacalcic sucrate; it is this sexacalcic which is produced, when an excess of  $CaO$   $HO$  is added to the

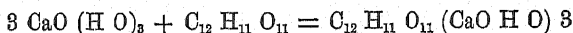
sugar solution, with disengagement of heat:—With the water at 15/100, the temperature rises 4·5 (+ 10·5 + 15), while from 30/100 it rises 9·5 (+ 10·5 + 20), and the lime dissolved corresponds to 19 or 20/100 (at + 10), which seems to justify Soubeiran's  $C_{24} H_{22} O_{22} (CaO)_3$ , and to show that the quantity of lime varies with the temperature 22/000 at 0° — 15/100 at + 35°. Benedikt obtained a monobasic sucrate  $C_{12} H_{11} O_{11}, CaO$ , by adding chloride of magnesium to a sugar solution saturated with lime; hydrate of magnesium is precipitated until the solution contains one equivalent of lime. This sucrate is soluble in cold water, but when boiled gives a tribasic sucrate. It is precipitable by ordinary alcohol. Dried at 100° it would be  $C_{12} H_{10} O_{10} (CaO)^3$ . As the results obtained above are all rather vague, both as regards the theory and compounds obtained, Dr. Maumené takes up this subject and works it out according to the theory established by him, and which we have before noticed. Now, according to this theory, lime acting on sugar in solution is always in the hydrated state; because, even when quick lime is used, it first unites with the water before acting on the sugar contained in solution. In this view we have the equation—

$$\boxed{M} \quad n = \frac{28}{9} = 3$$



And this hydrate, as it forms, unites with the sugar, and gives

$$\boxed{M} \quad n \frac{171}{55} = 3$$

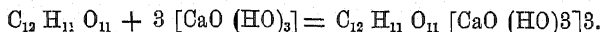


That is to say, the tribasic trihydrated sucrate of Ramsay and others. In this liquid the lime, although truly in combination with the sugar, does not lose its alkaline properties, and in consequence has a very disagreeable taste. The optical characteristics of the sugar are, however, considerably modified. When the solution is heated to 80° it becomes a thick paste, but the compound does not appear to be modified in any way, as, on cooling, it again becomes fluid, and offers the same properties, without any exception.

Solutions of sucrate, when acted on by carbonic acid, exhibit some very remarkable actions; actions which are of the greatest importance to chemists and refiners. The carbonic acid, when passed into solutions of sucrate, is absorbed in considerable quantity, before the production of any precipitate; the carbonate of lime produced at first forming a compound of sugar, lime, and carbonic acid, the true composition of which varies with the proportion of these elements present. This compound, at first soluble, ceases to be so on the diminution of the excess of the sucrate, and it then appears as a gelatinous milky white body, apparently a multitude of crystals so small that no one as yet has been able to distinguish their form. According to Bovin and Loiseau, this body has the following composition:— $C_{12} H_{11} O_{11} (CaOHO) 3$ ;  $(CaO CO_2) 3$  or  $C_{12} H_{11} O_{11} (CaO)_6 (CO_2) 3$ , from which it is seen that half of the lime is united to the sugar, in proportion corresponding to a tribasic sucrate, and the other half to the carbonic acid, to form carbonate of lime. Bovin and Loiseau have given to this compound the name of "Sucrate of hydrocarbonate of lime." Whether this body be a true compound, or only a mixture, is a question which has given rise to considerable discussion among chemists. That it is a true compound we do not doubt, although, at the same time, it is very difficult to give a precise idea of its formation. Dr. Maumené says its composition seems to vary, and in support of his statement gives the following experiment: Into a solution of sugar, containing 100 grammes of pure sugar in 600 or 800 grammes of water, are mixed 60 grammes of  $CaOHO$  (pure). About 22 grammes of the lime are dissolved, and the solution then represents very nearly  $3C_{12} H_{11} O_{11} (CaO) 4$ . When filtered, the clear liquid absorbs a certain quantity of carbonic acid, without showing any turbidity, if it be kept constantly agitated. But if, instead of filtering, we leave the liquid with all the lime, the half of which is dissolved, the carbonic acid gas is absorbed in large quantity, and gives, on filtration, a liquid from which that acid can be liberated, by the addition to the filtered solution of a stronger acid. If the degree of alkalinity of the original sucrate be taken, and then that of the carbonated liquid, it will be found that the alkalinity has been considerably reduced in the latter, and that the

degrees of alkalinity of the two approach very nearly :: 2 : 3. The carbonated liquid has apparently become  $3 \text{ C}_{12} \text{ H}_{11} \text{ O}_{11} (\text{CaO}) 6 (\text{CO}_2) 2$ . The titrage may be made at different times, and after the addition of larger and larger quantities of carbonic acid, but it will be found that the filtered part will always give the same degree of alkaline richness, as long as the insoluble sucrate of hydrocarbonate is not precipitated. In this reaction the sugar does not unite with the water, but the lime does; and not only so, but it unites with an equivalent weight, 28 to 27, and forms the hydrate  $\text{CaO} (\text{HO}) 3$ . The sugar then unites with this hydrate.

$$\boxed{\text{M}} \quad n = \frac{171}{55} = 3$$

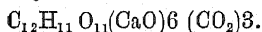


(It is this action, inevitable on application of heat, which gives the known tribasic sucrate.)

When this compound, produced in the cold, is brought in contact with hydrated carbonate of lime  $\text{CO}_2 \text{ CaO} (\text{HO})_5$ , the two bodies unite in equal weights, and we have

$$\boxed{\text{M}} \quad n = \frac{336}{95} \frac{(171-165)}{50+45} = 3.5$$

And from this  $2 \text{ C}_{12} \text{ H}_{11} \text{ O}_{11} [\text{CaO} (\text{HO})_3]$  united with  $7 \text{ CO}_2 \text{ CaO} (\text{HO})_5$ , and, by reuniting the separated parts of the same elements  $(\text{C}_{12} \text{ H}_{11} \text{ O}_{11})_2 (\text{CaO})_{13} (\text{CO}_2)_7 (\text{HO})_{41}$ , which is the true composition of this new body, "the sucrate of hydrocarbonate of lime." On reducing the last equation to  $\text{C}_{12} \text{ H}_{11} \text{ O}_{11} (\text{CaO}) 6.5 (\text{CO}_2) 3.5$ , we can easily understand why Bovin and Loiseau have taken



As the composition of their new body.

Among the uses made of sucrate of lime by manufacturers we note that of the "Turnbull" process. In his process, Mr. Turnbull, an English tanner, has taken advantage of the affinity of lime for sugar by neutralizing the limed hides, in the tanning process, by means of a sugar solution, and thus rendering them very permeable to the bark extract, so much so, that the tannin is absorbed by the skins in 15 days instead of as many months.

Baryta unites very easily with sugar in the form of crystals, the



formation of which are rendered more easy by the application of heat. Peligot found the composition of this salt to be  $C_{12} H_{11} O_{11}$ , BaO, which was contested by Liebig, but confirmed by Soubeiran.

Sugar unites with many other oxides to form sucrates, which, however, owing to the apparent variability of their composition, due, no doubt, to the different methods employed for their production, require to be further studied, in order to fully comprehend the different actions taking place, and the true composition of the salts formed. While on the subject of the sucrate of lead, and in reference to the insolubility of this salt, owing to which sugar might be considered as a good antidote in cases of lead poisoning, Dr. Maumené quotes a curious circumstance, which happened during the Russian campaign:—"Several loaves of sugar had been packed "into a box containing a few bottles of the extract of saturn. One "of these bottles got broken, and the liquid was absorbed by the "sugar. Owing to the scarcity during the retreat, recourse had "to be made to this sugar, and, although it was used with the "discretion necessary in the circumstances, the effects it might "produce were greatly feared. But, far from causing any bad "effects, it was found to be very nourishing, to act as a stimulant, "imparting a vigour and energy greatly required to support the "fatigues of such a march."

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### SUGAR IN 1877.

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Seldom has so complete a reversal of the position of a market taken place in so short a period as that which has occurred in sugar in 1877, and indeed, its general position may be briefly described as being exactly the opposite of what it was twelve months ago. Prices, which in December, 1876, were so high, and were then commonly expected to rise to famine point, are now lower than they have ever been, except for a short period in the spring of that year and in the winter of 1875, while the immediate prospects of the market, so promising for the sellers at this time last year, are now depressing in the extreme. The stocks in the chief European and American markets, which on the 31st October,

1876, showed a deficit of 128,000 tons as compared with 1875, at the same date in 1877 showed a surplus of 102,000 tons as compared with 1876. This has since greatly increased, and though complete returns are not available, it appears probable that the excess in the general stock as compared with 1876, is at present close on 150,000 tons. The heavy falling-off of 300,000 tons in the beet crop of 1876-7 bids fair to be replaced by a surplus of 220,000 tons in 1877-8 as compared with the crop of 1876-7. The promise of the coming and current cane crops is almost equally good, and it appears to be thought that they may even yield 200,000 tons more than their predecessors. While there is thus every prospect of exuberant supplies, the consumption, which steadily increased for many years, has been decreasing all over the world, and for the twelve months ended 31st October showed a falling-off of 103,000 tons for the countries of which returns are available, while, including the exports to those places from which no further information can be had, the decrease in the European and American total deliveries in the same period was no less than 200,000 tons, or close on 10 per cent.

To enlarge upon so singular a contrast is needless, for the figures speak for themselves, but though the alterations are so striking, their causes are perfectly clear. On the one hand, a rise of 1d. per lb. in retail prices caused the consumption to decrease rapidly, and the stagnation in the chief manufacturing districts of Europe and America increased the effect of the rise in values upon the demand from the public. On the other hand, the state of the European and North American markets offered a novel and very remarkable premium on the export of sugar to them. Indeed, in many cases, profits of 30, 40, and even 50 per cent. were realised on parcels sent here from the East Indies. Such almost unheard-of results, with a commodity exported, not by the pound, but by thousands of tons, of course led to the unknown but vast crops of India, China, and other parts of Asia (to say nothing of Africa and the Pacific coast of South America) being largely drawn upon. The great extent of the supply not usually entering the general market may be judged of from the recently-published official estimate of the value of sugar and molasses annually produced in India, which

is said to be probably more than £20,000,000. The Indian crop alone, at 10s. per cwt., would, if this were correct, weigh 2,000,000 tons, a figure probably under the truth. Attracted by the great rise in price last winter, sugars previously unknown even by name began to pour into the market in vast quantities, while countries like Russia, never before heard of as exporters, suddenly sent us a sufficient weight to have an immediate effect on prices. While many of those who were considered to be authorities continued to predict a saccharine famine, the date had to be continuously postponed, for the facts refused to tally with their presages of evil, and stocks accumulated while demand fell off. Nevertheless, even as late as July last, the trade were authoritatively informed that the stock in Great Britain was within a few months to fall to 53,000 tons; but when the period arrived, and more than three times that quantity turned out to be in store here, even the most credulous were driven to look facts in the face. Freed from the restrictions of Customs' tariffs, sugar had flowed from all parts of the world to fill the void in our stocks. Having no duty to pay, the English people can afford to give a higher bonded value than any other; and, even in these times of comparative scarcity, England has become more than ever the saccharine storehouse of Europe, and, to some extent, of America.

Since the beginning of the year the accumulating supplies have led to an almost continuous decline in prices, and 1877 will long be remembered by those who had to hold stocks as a most unpleasant period. On the other hand, the great sugar producing interest, and particularly its West Indian branch, benefited greatly by the high values of last winter and spring, and, indeed, those producers or importers who sold then, must have done better than for years past. With regard to the future of prices, it is difficult to hazard even the most guarded opinion, in so large a market, and one governed by innumerable causes—arising over so large a portion of the world's surface, and affecting a known production of 3,500,000 tons a year, and a vast, indeed, perhaps greater, unknown product. Still, it is evident that though prices are unusually low, the stocks are also rather below, instead of above, the average, if the scale of deliveries in this and former years be

taken into account. The supplies from unexpected quarters cannot be expected to recur, now that the inducement to exportation is removed. Indeed, it seems likely that there may be considerable voids to fill in the home stocks of India and China. Already the quantity afloat from the East shows a falling-off, while for months past it has shown an excess. The beet crop, though heavy, is early, and the pressure to sell it has been greater than usual. This will soon be at an end, and with the current low prices the general consumption may be expected to revive. Indeed, it has already begun to increase in this country and in the States, which form the chief consuming markets. On the whole, therefore, a continuance of the late depression would hardly be reasonable, and, indeed, a moderate increase in values later on seems not improbable.

The following is a comparison of the estimated average price of raw sugar at the end of 1877, with that of former years at the same time :—

Increase or Decrease at the end of 1877, as compared with	Bonded Price.		Duty Paid Price.	
	Increase.		Decrease.	
	s. d.	s. d.	s. d.	s. d.
1876	..	9 0	..	9 0
1875	1 0	..	1 0	..
1874	..	1 6	..	1 6
1873	..	1 6	..	4 0
1872	..	4 6	..	8 6
1871	..	6 6	..	11 9
1870	..	3 6	..	13 4
1869	..	1 6	..	11 4
1868	..	1 6	..	11 4
1867	..	2 6	..	12 4
1866	..	0 6	..	10 4
1865	..	4 6	..	14 4
1864	..	7 6	..	11 10
1863	..	6 0	..	23 8
1862	..	3 0	..	19 8
1861	..	2 6	..	19 2
	Average Decrease for 1877 as compared with previous years.		Average Decrease for 1877 as compared with previous years.	
		3 6		11 3

One of the most interesting facts in connection with the trade is the rapid development of the demand for crystallised raw sugar which has occurred within the last two or three years. This year the consumption has been larger than ever, and so great is the hold raw sugar has obtained upon the public taste, that at one period, when it was exceptionally dear as compared with other kinds, the demand was only slightly affected, notwithstanding that the retail price was a penny per pound above that of fine pieces. The Demerara planters have made for themselves quite a special reputation for the manufacture of this class of sugar, and the produce of some of the large estates has reached a degree of perfection which was quite unknown a few years ago. At the period mentioned above, when Demerara sugar was exceptionally scarce, several of the refiners endeavoured to make imitation raw sugar with similar grain and complexion. In spite of the fact that they were unable to attain to the peculiar rich flavour which is one of the great recommendations of the real article, they were able to obtain a price 5s. or 6s. above that which they could get for their ordinary pieces of a similar colour. It is evident, therefore, that a considerable proportion of the community no longer buy their sugar by colour only, and the reputation their produce has gained must be most encouraging to the Demerara planters. It should also lead to our other colonists following their example, especially in places like Mauritius, where the proper machinery is already at work, but where the manufacturers persist in making sugars unsaleable for direct use in this country. The interest with which the first cargoes of Demerara are now looked forward to is unparalleled in the history of the sugar trade, and almost equals that which attaches to the first shipments of tea and valencias. With regard to the prospects for the ensuing season, it is stated that the Demerara crop will be smaller than last year, owing to the want of rain, which has been severely felt for the last six weeks. On the other hand, owing to the good beet crops, the French refiners will not be buyers of crystallized cane to the same extent as last year, while the increased vigilance which is now used by the United States customs officials will probably considerably restrict the American demand. A much larger proportion of the crops is,

therefore, likely to come here than was the case last year, and as so many other producing countries are now making crystallized sugar, there is every prospect of an adequate supply.

Considerable progress has been made in the drawback question during the past year, for the Austrian export bounties, which had more than swallowed up the revenue derived by the empire from home-grown beet, have been materially reduced. The United States bounties on the export of Refined have been practically stopped, and public opinion there is becoming alive to the idea that all these difficulties would be stopped if there were a uniform duty on all sugars. In France, also, some progress has been made, for public men of all shades of politics have gradually been made aware of what has gone on for many years past, and once generally known, such a system cannot survive. Indeed, it seems probable that the attention drawn to the system has already had the effect of materially decreasing the abuses inseparable from it. The policy of granting direct export subsidies to a great national industry, though it may be mistaken, is intelligible, if it be avowedly taken in hand; but to give an indirect bounty of unknown amount to a few individuals, in the hope that they may be induced to hand it on to the thousands of persons for whom the benefit is intended, is to subject human nature to a strong trial, and to make the greatest call upon the national Treasury with the least result. If France is determined to subsidize her sugar trade, let the Government put a stop to the present round-about system, and propose a direct vote to Parliament of so many francs per ton on all exports of home-grown raw beet. That, after all, is the industry meant to be benefited, and such a proposition would, at any rate, have the advantage of being a straightforward one, whether the policy would be wise or not. To those who are aware that cane sugar can in many places be grown at nearly half the cost of beet, it certainly seems a mistake to suppose that any bounty that France can afford can equalise the cost of producing the two. It would rather appear that any premium on exports of the kind would do harm, instead of good, to the latter, by precipitating a conflict between cane and beet sugar, which might otherwise be indefinitely postponed.—*The Produce Markets Review.*

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TESTING THE VALUE OF LUBRICANTS.

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In our last issue we gave, under this heading, and in a condensed form, a paper read by Mr. W. H. Bailey, of the Albion Works, Salford, before the Manchester Association of Employers, Foremen, and Draughtsmen. That gentleman having since favoured us with the following complete copy, and enabled us to reproduce it with illustrative diagrams, we have not hesitated to avail ourselves of his kindness, the subject being one in which so many of our readers are interested:—

A fact in connection with oil and lubrication is probably about as difficult a thing to describe as anything which agitates the minds of engineers and mechanical men.\* We appear to have very little published information on the subject, except that which describes the labours of Morin, of France, about forty years ago, and that which has been given to us by Professor Rankine, more recently, in this country. Those investigators who preceded Morin do not appear to have published information of very much value, or which can be used with profit for our subject, for their researches have been more concerning the proportions of bearings, and the value of different materials of construction, rather than the value of different lubricants.

“At the present moment so little is known generally concerning the performance of different oils, that the public are much at the mercy of the vendors of these oils, who can make almost any assertion they like without fear of contradiction.”†

*Thermo Dynamics.*

The valuable discoveries of our distinguished townsman, Dr. Joule, have enabled us to look upon the cost of friction and the cash value of heat as mere questions of arithmetic. Dr. Joule's investigations have been put into such forcible and elegant English by Professor Tyndall, and other students of the science of force, as

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\* “There are few men who can accurately describe a fact.”—*Smiles' Lives of the Engineers.*

† *Engineer*, November 10th, 1877.

to cause us to understand that when friction is produced heat is lost, and that all energy thus wasted passes away in this heat, which may be measured and valued with nearly as much facility as any article of commerce. We may gather from this knowledge, when we apply it to workshop economy, that if a pedestal or bearing becomes so hot through friction as to cause one pound of water to be raised only one degree Fahrenheit in temperature in one minute, that heat has been lost equal to that which would be created by a weight of *one pound falling through a space of 772 feet*. We are told that if we apply this conversely,—that heat has been lost which would lift one pound weight 772 feet; and if we apply these illustrations still further, and imagine 42 pedestals or bearings losing heat by friction in a similar manner, we may inform ourselves that we are losing nearly one horse power, because they represent 32,424 foot pounds of force. And if we know from our books what our coal costs, it will take very little trouble to give us the exact cash value of this friction and destructive action.

#### *Friction.*

What is friction?

It may be described as the effect produced by two bodies sliding one upon the other, which have upon their opposing surfaces minute asperities, which interlock with each other. The sliding movement which forcibly removes these minute irregularities creates what we call friction. Friction is reduced when these asperities are small, and lubrication is resorted to to prevent that loss of power caused by motion under these conditions.

The chief lubricants used are oil and tallow, which have a less co-efficient of friction than the parts in contact. It may be well now to state that the term “co-efficient of friction” is an expression which indicates the proportion which resistance to sliding bears to the force which presses the surfaces together. There is little friction when this amounts to only one-twentieth, it is moderate when it is one-tenth, and it is very high when it is a quarter or twenty-five per cent. of the force which presses the surfaces, as I before said, together.

#### *Qualities of Lubricants.*

Good lubricants should have the following qualities:—



- I. Sufficient body to keep the surfaces free from contact under maximum pressure.
- II. The greatest possible fluidity consistent with the foregoing condition.
- III. The lowest possible co-efficient of friction.
- IV. The greatest capacity for storing and carrying away heat.
- V. A high temperature of decomposition.
- VI. Power to resist oxidation, or, in other words, the influence of the atmosphere upon them.
- VII. Freedom from corrosive action on the metals upon which they are used.

It will thus be seen that many conditions have to be carefully taken into consideration; and further, it may be stated that an oil which may be good for heavy bearings may not be desirable for use on light spindles, and for delicate machinery like clocks and watches, where very little power is required to be transmitted beyond that of overcoming their own inertia; and also that oil which is good for small machinery running at quick speeds is very often useless for heavy pressures and large shafting.

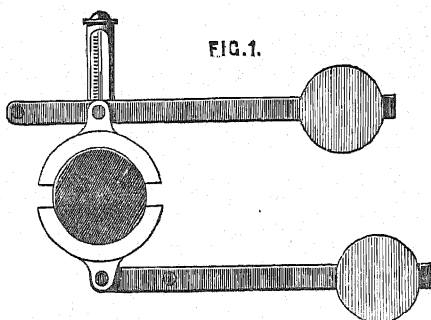
For very heavy bearings, tallow and other solid lubricants are used, such as mixtures of sulphur and tallow, asbestos, soap-stone with asbestos, graphite, caustic soda, beeswax, and other similar mixtures, which find favour among locomotive engineers and those in charge of heavy machinery.

The pressure that can be borne by a good lubricant for a useful length of time depends upon the nature of the bearings as well as upon the lubricant itself. The velocity of the rubbing action also must be taken into consideration. The maximum of pressure that solid lubricants will bear without destruction is unknown. For steel surfaces, lubricated with best sperm oil, moving slowly, 1200 pounds pressure per square inch of bearing surface has been found permissible. Under the pivots of swinging bridges several thousand pounds per square inch have been found to work, and for iron journals 800 pounds per square inch should not be exceeded.

Lubricants in the market vary much in cost, as well as in

quality; and, very often, it is found that the varying prices bear little or no relation to the value of the article purchased. Probably the best test of value is one with which I was familiar some years ago. It consisted of a small engine very much over worked, which stopped and refused to move or go at the proper speed if the shafting had not been lubricated with good oil.

*Testing by Destruction.*



FRICITION TEST. Patent.—(*H. Stapper.*)

The instrument, Fig. 1, to which I now call your attention, consists of a bed-plate, having upon it a piece of shafting upon which friction is created by means of two brass steps, the speed at which it is driven being about 300 revolutions per minute. The friction is brought to bear by levers and weights somewhat after the manner of a friction brake. In the top step is a thermometer for indicating any increase of temperature caused by the friction. A small index indicates the number of revolutions that the shaft makes for any given temperature which the friction causes the thermometer to indicate. The machines used for testing oil have the friction shaft, where the oil is destroyed, three inches in diameter. Those for tallow are of larger dimensions.

It will be seen that on ascertaining the number of revolutions which may be obtained without generating heat, or with the lowest possible increase of heat, that the value of the oil can be obtained. That oil which allows the greatest heat to accumulate with the fewest revolutions must be a bad lubricant. This tabular method of keeping an account of experiments has been found useful.

The machine is stopped when the thermometer indicates 200 degrees, as it is considered that an oil has not much lubricating power left if it permits that heat.

Name of Oil.	Price.	Revolutions to 200 degrees, F.	Temperature of Atmosphere	No. of Revolutions to each deg.

\* When testing with this machine a definite quantity of oil should be placed on the friction roller, the top step being removed for that purpose; the quantity should be about five drops. A glass tube or small tin measure should be used, as drops vary in size according to the temperature of the oil, and also differ with the specific gravity.

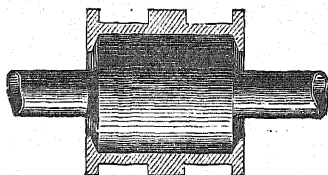


Fig. 2.

Lipped Steps of the First Stapfer Tester.

The inventor of this machine is Mr. Heinrich Stapfer. I believe he may be considered the inventor of the first instrument for testing oils by destroying them by friction under the actual conditions in which oils are used as lubricants. In using this machine I found that, although it was supposed to test lubricants in the way in which they are used in manufactories, a slight difference existed, which prevented accurate results.

#### *Behaviour of Thin Oils.*

The first machines were made with the brass steps lipped, or recessed, to prevent the oil running away, see Fig. 2, which, when thus tested, gave results very much different to those which are accepted by those who are familiar with the use of lubricants. For instance, some thin mineral oils were found to be quite as valuable, and in some cases, superior to sperm; and this was caused by the lips on the sides, which prevented the oil from running off the bearing when an increased fluidity was caused by

friction, and by any slight elevation of temperature. This is a very important quality in lubricating oils, probably next to the capacity to resist oxidation, the most important to be criticised by those who wish to value a lubricant. Although this experiment points out to us that it may be advisable to make the journals of heavy bearing similar to these, if we wish to obtain the best results from cheap, thin oils; yet, as oil should be criticised and prepared to be used on bearings with parallel necks, such as are used in works, it was considered proper to alter the tester to that shape to make the conditions similar.

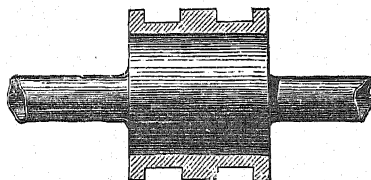


Fig. 3.

This illustration, see Fig. 3, permits the oil when tested to run away from the bearing if its increased fluidity gives it a tendency to do so. It is this severe test which has enabled sperm oil to rise superior to all rivals, because it has these two apparently opposite attributes,—body or thickness, which keep it on its bearing, combined with sufficient fluidity for lubricating purposes.

Permit me further to illustrate what I mean in another manner. Suppose we take an oil, good as a lubricant in all other respects, and place it on a bearing, and that forty per cent. works quickly away because of its extra fluidity when subjected to an increase of frictional temperature, and then compare it with another oil under similar conditions which only wastes—say five per cent.

This latter will be thirty-five per cent. superior as an oil having body, and, even if slightly inferior as a lubricant, it may be the most valuable, because strong in this one great quality of remaining at its duty when placed in position. Still another illustration will inform us that in the one case we obtain, say 60 gallons of lubricating material out of every 100 purchased, and in the other we obtain 95 gallons.

*The best Methods of Using Thin Oils.*

This will show us that oils which are deficient in body, but which are good in other respects, may be used with good results, if doled out in small quantities, as required, by automatic oil cups like the Lieuvain needle lubricator Fig. 4, or any other means.



Fig. 4.

Journals which cannot be fed by means of automatic oil cups in positions difficult of access should be fed with oil which has a good body.

If space permitted, much might be said of the proper shape for bearings of machinery,—a subject which would lead to valuable results if discussed by the members of this Society, many of whom must have great experience of those designs which have produced the best results, as well as of those mixtures of metals which are the most durable for light high speed and heavy slow speed shafting. If any member will take up this subject, or if several members will read short notes, giving their actual experience of different sorts of footsteps, pedestals, and spindles, as well as of the use of different sorts of oil cups and lubricators, it will be highly advantageous knowledge, which must be of great value to all who use machinery.

*Fluidity of Oils.*

Continuing my remarks on the thinness or fluidity of oils, I wish to call attention to an ingenious arrangement for testing the fluidity when subjected to a slight increase of temperature, and also for detecting any tendency which they may have for combining with the oxygen of the atmosphere, this latter quality

being advantageous in oils which are used to mix with paint, but which is a great evil when used for lubricating purposes. A piece of plate glass, placed at an angle, is made warm to 200° Fahr., a drop of oil when placed upon the upper end of this glass, will flow down a few inches, and thus indicate its fluidity when subjected to increase of temperature.

*(To be continued.)*

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FOREIGN SUBSTANCES IN RAW SUGAR.—In the course of an interesting lecture “On the Impurities in Raw Sugar,” lately delivered at Greenock, Mr. Neill, a sugar refiner, of that place, displayed a number of “foreign” impurities imported in sugar, such as a crowbar, brickbats, stones, a piece of volcanic mud, an old stirrup, a Chinese head-dress, and other articles of dress worn by the workers on the sugar plantations and at the shipping ports, and which found their way into the hogsheads and bags through carelessness, and sometimes to make up weight for sugar that had been stolen. Mr. Neill said he knew a Greenock refiner obtain no less than three tons of large stones out of one cargo of sugar. One of the chief impurities in sugar was sand, and in Mauritius sugar there was found  $1\frac{1}{2}$  per cent. of that substance.

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### THE FRENCH COMMERCIAL TREATY.

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The following was received by the Greenock Chamber of Commerce on the 17th January:—

Foreign Office, January 16, 1878.

Sir,—With reference to previous correspondence relative to commercial negotiations with France, I am directed by the Earl of Derby to acquaint you, for the information of the Greenock Chamber of Commerce, that M. Waddington has stated to Lord Lyons that he cannot resume these negotiations at the present moment. M. Waddington has said, further, that it is advisable that these negotiations should continue to be suspended until a return of commercial tranquillity and prosperity will afford an opportunity of taking them in hand with a good prospect of success.

Under the circumstances, Her Majesty's Government have expressed concurrence, and have asked for due notice when the French Government will propose to resume them. A further communication will then be addressed to you on the subject.

I am, sir, your most obedient humble servant,

I. V. LISTER.

The Secretary to the Chamber of Commerce, Greenock.

The above does not affect the Sugar Convention.—ED.

## Correspondence.

### THE SUGAR CANE IN PORTO RICO.

TO THE EDITOR OF "THE SUGAR CANE."

Sir,

Will the culture of the sugar cane be continued or abandoned in Porto Rico? There are many thoughtful men in that island who are pondering on this question, without, as yet, having arrived at a satisfactory solution of it.

Nature has indeed done her utmost to favour Porto Rico, and to make the sugar cane prosper there. Climate and soil are as favourable as could be desired. Few countries have lands as good, and as well watered. The districts of Ponce and Guayama contain soils as rich as can be found anywhere else, yielding, without any particular care, those fine grocery sugars for which Porto Rico is renowned. If these districts suffered less from want of rain they would be unrivalled in fertility.

The island does not suffer from any want of population. Though smaller than Jamaica, it has 650,000 inhabitants, and, with the single exception of Barbados, it is the most densely populated country in America. There is no ill-will between blacks and whites. Both races work together in the cane fields.

The estate owners are, certainly, far from having mastered all the difficulties of their trade, but they have done as much as could be fairly expected from them. If their mills are not as powerful as they should be, if the vacuum pan and other modern appliances are not used extensively in the island, it must be attributed to their want of *means*—not of *will*. There are no large estates in the island (one making 600 tons of sugar is considered a large one), and the expense of a vacuum pan is scarcely within the grasp of any but large estate owners. The appliances which they do have, however, they handle well, for there is no exaggeration in saying that there is no better sugar made in the open battery than the Porto Rico sugar. On the other hand, their planting, though also open to criticism, is not at all bad. Their ploughing is very fair (in some estates it is done by steam power); the distance between the furrows, and

between the stools, is properly kept; due attention is given to weeding, and draining, and irrigation is carried out where it is considered necessary, sometimes at an enormous expense. Some canals have cost £12,000. Manure is extensively employed, though far from being done with the care and knowledge this branch of agriculture requires. Everything considered, I believe it may be fairly said that the cultural part of the trade is as well done in Porto Rico as in the most advanced cane producing country in the world, and the best proof of this is that one acre of autumn plants is not considered to have yielded a fair return if it has not produced three tons of sugar and about 230 gallons molasses. A yield of four tons per acre is no extraordinary thing, and I have known cases of a much larger yield. Spring canes are expected to yield two and a-half tons of sugar and about 185 gallons molasses to the acre.

It will appear astonishing that there should exist any doubts as to the possibility of continuing the culture of the sugar cane in a country where nature is bountiful, where the population is dense, and where the work, though far from perfect, cannot be said to be bad; yet, these doubts do exist, and the reader will not find them altogether groundless if he reads to the end.

Whilst France, Germany, Belgium, Holland, and the United States, pursuing, what I believe to be, a mistaken policy, have been trying to foster and bolster up their sugar industry, what has the Spanish Government been doing? It has done, Sir, and is apparently still doing all in its power to strangle the sugar trade in the West Indies. In order to protect half-a-dozen influential estate owners in Andalusia, the sugars from the Spanish Colonies are banished from Spain. Instead of endeavouring to smooth over the difficulties under which Cuba and Porto Rico labour, she seems bent on aggravating them by keeping in force her prohibitive duties. These are so efficient that not a single hogshead of sugar finds its way to the mother country, *whose goods are protected against competition in the island.*

Yet this could be borne if the planter was not weighed down by excessive taxation. The Government and municipal taxes are about £1 10s. per ton of sugar made. Besides this, there is an export duty of £1 per ton of sugar, and 50 cents on every 110



gallons molasses. It may therefore be roughly said that the total amount of *direct* taxes paid by the planter is about 50s. per ton of sugar. These of course are only the *direct* taxes; the *indirect* ones (which are certainly not one farthing less than the others) are rather difficult to gauge, but some idea may be had of their importance by simply stating that *rice*, which is the principal food of the population, pays a duty of 3s. 9d. if imported in Spanish, and 4s. 9d. if in a foreign bottom, for every 100 lbs.

Whilst slavery existed, all this was borne pretty well, though not without intense suffering; but when slavery was abolished the inevitable crisis came. Few planters were out of debt (and debt, in a country where the rate of interest is between 12 and 18 per cent., per annum, is a serious thing), and, being deprived of their slaves, without receiving the indemnity that was offered, but is not yet paid, they saw ruin staring them in the face. Their critical and difficult situation was rendered still more so by the low prices of sugar for 1874, 1875, and 1876, and by the lack of rain in some of the richest sugar districts in the island.

The Planters have struggled, and continue struggling manfully against the numerous evils that beset their path, but many have given way already, and the process of dissolution is fast doing its work with many others. This will clearly be seen by looking at the following figures, which show the production of sugar in Ponce, the richest sugar district of the island, for the last six years.

	SUGAR.			MOLASSES.	
	Hhds.	Barrels.	Pounds.	Puncheons.	Galls.
1872.....	28,228	4079	39,900,153	11,146	1,473,940
1873.....	25,863	3166	36,059,519	10,647	1,433,880
1874.....	20,453	3783	27,771,840	10,621	1,420,626
1875.....	18,327	3691	24,645,253	9,756	1,370,522
1876.....	14,259	3710	18,430,587	7,769	1,035,063
1877.....	16,017	3579	22,073,965	7,632	990,660

Let me observe *en passant*, that the disproportion between molasses and sugar shown in the above figures, is not due to any particular defect in the process of sugar-making generally followed: it is done so *intentionally*. The planters are paid for it from \$30

to \$43 for every 110 gallons (the cask is furnished by the buyer), and when the price of sugar is low they find it to their profit to *boil low*, so as to make as much molasses as possible. It may be observed that in 1875 and 1876, when the price of sugar was lowest, the proportion of molasses was larger than ever.

If the Government lent a helping hand to the planters, all might still be saved; but there is nothing yet to warrant the hope that this helping hand will be offered. In the last session of the Spanish Congress the Porto Rico Deputies once more claimed their right to import their sugar into Spain duty free, and asked for a diminution of their taxes, but they met with a deaf ear, and returned to their constituents with empty hands. Under these disheartening circumstances, it is no wonder if thoughtful men entertain fears as to the future of the sugar cane in Porto Rico, and if the profitableness of its cultivation there is a subject of doubt and discussion.

I remain, sir, yours truly,

GUSTO. CABRERA.

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## THE CULTIVATION OF SUGAR BEET IN AMERICA.

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TO THE EDITOR OF "THE SUGAR CANE."

Dear Sir,

I have been struggling for some years past to introduce to the Canadian and American farming population of this continent the beet sugar manufacture. I am happy to say my labours, with those of others, have produced a considerable effect on the public mind, which has led to varied and extensive experiments on the part of the Government of the province of Quebec, and finally to the offer of a very handsome premium to the first beet sugar manufactory which may be established under the directions of the Bureau of Agriculture of that province. The experiments in growing the root, through almost all the counties of Quebec, and its subsequent analysis, both in Canada and in Europe, have shown, in an indubitable manner, that the soil and climate of that province are admirably adapted to the industry.

Now the soil of Ontario is fully as good as that of Quebec, and the climate is far better. The sugar beet (from the best imported

seed) is largely grown in Ontario instead of the mangold, and is fully approved. Analyses and experiments, on a large as well as on a small scale, have shown clearly that our country is quite as well adapted to the beet sugar industry as that of Europe.

The chief difficulty which meets us on the threshold of the subject is the fact that the sugar beet, owing to its containing so much water, will not bear carriage. We can and do grow it, and store it, and keep it through our severe winters. We can do this, and do it as *cattle food*, and find a profit in doing so ; but the profits of turning the root into use, as a source for sugar, have been closed to us, owing to the complicated nature of the process of converting the juice into that article,—the unknown profits of the industry, and the hesitation of capitalists to embark in it. It is too difficult a business for any person to undertake with any chance of success, unless he understands the proper manipulation, and has, moreover, a chemical mind, so as to meet and conquer the difficulties which arise in the process. European beet sugar manufacturers are, also, farmers and growers of the root, and there seems to be a prevailing opinion that none but the manufacturers of the sugar are capable of growing the root. This is a great error, and cannot be too soon swept out of the way. At all events, such a notion on the American continent would keep back the manufacture for an unlimited period. The experiments in the province of Quebec, and private enterprise in Ontario, have proved the goodness of the farmers' roots. Experience has shown that in Europe the beet sugar business starts from a series of circles and isolated spots. The grower is governed by his nearness to the factory, and the ease with which he can convey his roots to that work.

This will not do in America. We are a country of such "magnificent distances" that the conveyance of the roots to the factories, which latter will naturally be started in the neighbourhood of cities and centres, must be provided for.

To do good to the "country" generally you must make growing beet root a *general* and popular custom, and you must be able to reduce the root to a carriageable article of not less value, bulk for bulk and weight for weight, than coarse grains. This can only be

done by breaking the business in two, as it were, and leaving the reduction of the bulk, as well as the production of the root, in the hands of the farmer. This can be accomplished in two ways. First, by slicing and drying the root; and, secondly, by preparing an inspissated juice, that will keep and yet bear carriage.

Drying cannot be too much condemned. It destroys at once all the benefits which the farm would derive from the growth of the root, and therefore ought to be put out of the category altogether. The preparation of an inspissated juice is by no means beyond the abits and customs of the farmer. His horse power affords him the necessary machinery for reducing the roots. The common cider press gives him the means of extracting the juice, or at all events of the principal portion of it; the rest goes to the cattle. The reduction of that juice to an inspissated state, or concrete, is all that will be necessary; and this the principles involved in Fryer's Concretor render easy. The juice, as pressed direct from the roots, cannot be evaporated in the simple kettle over the fire without burning, and burning is destructive; but adopt the principles of the Concretor, and the difficulty is at once removed.

The Concretor has shown that nothing evaporates moisture so fast as a current of heated air. The Concretor, in its present shape, is too magnificent an affair for the Canadian or American farmer, but its principles are all important, and show the way out of the difficulty.

The following plan will only answer with charcoal, anthracite, or smokeless coal or coke, because, for the sake of economy, we want to make use of the direct heat, and yet avoid what little smoke there may be, both in lighting the fire and in that which arises before it burns clear. In Canada and America, where we have so much smokeless fuel, no difficulty can arise. Where smoky fuel is necessitated, the apparatus must be arranged to keep the smoke out of the contents; and this is quite possible, but will somewhat increase the expense of construction. The following adaptation of the invention is original, and of course patentable; but as I am working to introduce the manufacture of beet sugar in such a way that the farmer and the manufacturer shall benefit alike, I publish it as public property.

The apparatus is as follows :—A chimney is built, communicating with a stove best adapted for burning anthracite, and carried to a sufficient height to secure a good draught. The sides of the fireplace must be coated with fire-brick, and the grate properly adapted to the fuel used.

There must be an attachment built to the side of this chimney (the whole being brick work), and it must communicate with the chimney by three or four apertures, all of which can be closed by dampers. These may be either on the throttle-valve principle or by slides; but, however they may be arranged, they must, when required, fit close and tight.

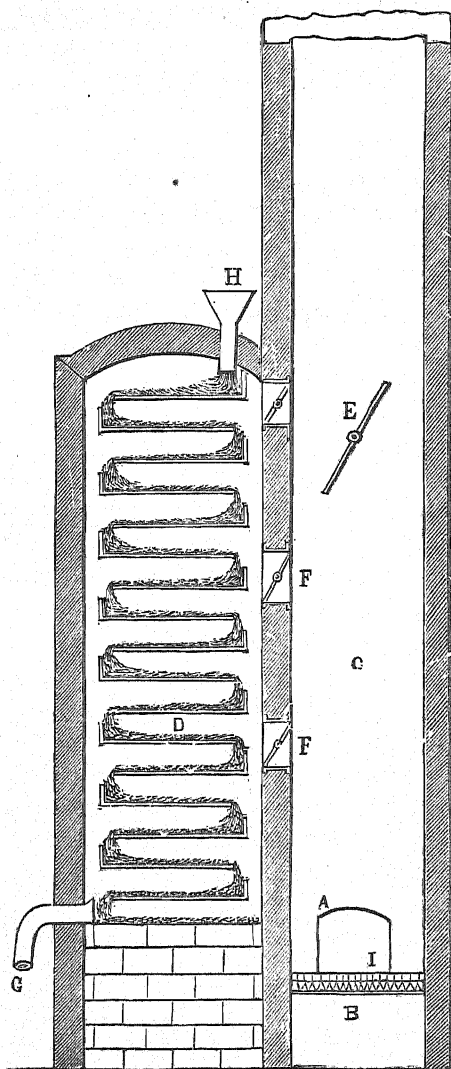
This attachment, which is a kind of oven, and which, in describing it, we shall call the oven, is made of any size, according to the magnitude of the work to be done, but is carried about 8 or 10 feet high above the surface of the first aperture, which must be just above the fire. The other apertures are about two feet apart. Opposite the upper part of this oven, and about 8 inches from the top of the inside, is another aperture, leading directly into the chimney, and of sufficient capacity to carry the whole of the draught of the chimney and fire. Below this aperture in the chimney must be fixed a damper, with full power to turn it off and on and regulate it. The effect of these apertures and dampers will be that, when the damper in the chimney is open, the whole draught of the fire rushes up the flue in an uninterrupted state (the dampers which communicate with the oven being closed at the same time). Thus all smoke and the results of combustion can be carried straight up the chimney, or turned through the oven at pleasure.

The three sides of the oven, where smokeless fuel is used, will be of brick work, the fourth side being closed with iron shutters, which fit tight and close, but which, when opened, afford free access to the whole of the inside of the oven.

The inside of the oven is fitted with iron trays, which empty or drip from one to the other all the way down. They do not fit quite tight against the walls, but stand off an inch or two. The sides and one end of these trays are about three inches high, to prevent splashing, and they are supported by iron supports built into the

wall. The trays are all moveable, and can be taken out to be cleaned, or they can be cleaned where they are with steam.

The following diagram will explain my meaning:—



A. The fire grate.

B. Ashpit.

C. Chimney.

D. Oven, or evaporator.

E. Damper, or valve to close the chimney, and drive the heat through the oven.

F F. Flues, or means of passing the heat from the fire into the oven, all closeable with throttle valves or dampers.

G. Exit for concrete.

H. Supply pipe to the oven.

I. Fire grate.

Now, it will be seen that a small stream of juice, being allowed to trickle on to the upper tray in the oven, would pass down in the thinnest possible stream, thus exposing the greatest amount of surface to the hot draught and gases of the fire, which pass through the oven. The current of heated air and the heat itself would cause rapid evaporation, and by the time the juice reaches the bottom tray, and runs out into the receptacle put to receive it, it is a thick syrup, and the bulk of the juice is reduced fully 75 per cent. A second running through the machine reduces it to an absolute concrete, liquid when hot, but solid, or nearly so, when cold. It then forms an inspissated juice, that will keep any length of time, and can be carried to market for any distance. The only thing to guard against is burning, and this can be done by a proper regulation of the fire.

Beet juice prepared in this way, and not burned in the operation, is just fit for manipulation in the beet sugar factory, where it would be readily purchased at its value.

The foregoing plan would answer various other purposes. For instance, in apple countries, the concentration of the apple juice to a sufficient strength to make "apple wine" instead of cider; and "apple wine" is as good as the best grape wine, and will keep quite as long.

The apple syrup, thus prepared, would be in just the right state to make apple "sass," or apple butter, a thing that will keep the year out, and is a well-known luxury all through America, and, by means of which, apple pies and other preparations of that most wholesome fruit are extended throughout the year. It may also be used for the drying of fruit, and indeed anywhere where the concentration of vegetable juices is required.

E. L. C.

Toronto, Canada, December 1, 1877.

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*Disinfecting Properties of Cellulosic Substances Carbonised with Concentrated Sulphuric Acid.*—F. Garcin.—Wood, paper, rags, &c., if plunged for a few moments into concentrated sulphuric acid, are transformed into a black substance, which is not pure carbon, but retains hydrogen, and approaches the humic products, and possesses a remarkable absorbing and disinfecting power.—*Comptes Rendus*.

## CONSUMPTION OF SUGAR PER HEAD.

We are indebted to the *Journal des Fabricants de Sucre* for the following table which shows the present consumption of sugar per head in the different countries named :—

	Tons.		Population.		Per head. lbs.
Great Britain .....	900,000	..	31,629,300	..	62·58
Germany.....	315,000	..	42,756,900	..	16·19
France .....	275,000	..	36,377,600	..	6·51
Russia.....	250,000	..	82,135,700	..	6·70
Austria .....	170,000	..	20,395,000	..	18·33
Spain .....	50,005	..	16,835,000	..	6·50
Belgium .....	50,000	..	4,827,800	..	22·65
Holland .....	30,000	..	3,579,400	..	17·50
Turkey .....	25,000	..	23,610,000	..	2·25
Sweden and Norway.	20,000	..	5,870,300	..	7·5
Portugal.....	15,000	..	4,324,100	..	7·5
Denmark.....	15,000	..	1,785,100	..	18·25
Switzerland .....	11,000	..	2,659,600	..	9·
Greece.....	3,000	..	1,457,000	..	4·59
<hr/>					
Europe .....	2,129,000	..	278,243,200	..	17·0
United States.....	759,000	..	38,925,000	..	42·35
British Colonies ....	200,000	..	50,000,000	..	8·8
<hr/>					
Total .....	3,079,000	..	367,168,000	..	17·5
Dominion of Canada.	82,491	..	4,365,000	..	39·5

LOUISIANA.—As greatly exaggerated reports about losses on sugar plantations are being circulated, especially in New Orleans, we have sought to obtain as much information as possible on this subject. Very naturally, as might have been expected after such a freeze, those who neglected to windrow what cane they could not grind immediately, finally had it commence fermentation, and in some isolated cases it would no longer make sugar; but while this was not the case until quite *two weeks* after the first ice, the yield continuing good in most cases all that time, it must be remembered that the cane which soured so that it will not granulate is really but a small portion of the crop, as more than half had already been by that time made into sugar; and the bulk of the other half was windrowed, and is now as good and yields as well as at any time during the season. There have been but *few* cases indeed (we know of but one small lot) where the juice would not granulate, and hence we are safe in saying that the loss in yield, under the circumstances, *cannot* exceed twenty-five per cent., and we do not honestly believe it will amount to more than ten per cent. of the whole crop.—*The Sugar Bowl*.



## MONTHLY LIST OF PATENTS.

Communicated by GEORGE DAVIES, C.E., Patent Agent, 4, St. Ann's Square, Manchester.

## ENGLISH.

## APPLICATIONS.

4682. HUNTER HENRY MURDOCH, 7, Staple Inn, Middlesex. *Improvements in the manufacture and refining of sugar.* (Communication.)

4682. HUNTER HENRY MURDOCH, 7, Staple Inn, Middlesex. *An improved bag-filter, to be used in sugar manufactories and refineries, and in other manufactories.* (Communication.)

4864. JOHN NEALE, 47, Lincoln's Inn Fields, Middlesex. *Improvements in moulding and compressing granular sugar, and in the machinery or apparatus employed therein.* (Communication.)

## ABRIDGEMENTS.

1911. THOMAS SMITH, of 106, Fleet Street, London. *Improvements in the mode of clarifying and of drying sugar in mould.* (A communication from Dominique Casalonga, of Paris.) This invention has for object to clarify and dry rapidly, in sugar manufactories and refineries, the sugar arranged in moulds, whatever be the disposition and size of these moulds. For this purpose a cap is arranged above each mould, fastened at top by any convenient means, and forming a joint by the aid of a plait or washer of caoutchouc. Upon this cap, which is dome-shaped, is a cock and funnel, to receive the desired quantity of "cleare." This cap leaves a space above the surface of the sugar in the moulds, into which space compressed air is caused to enter by suitable means. The cocks permit the compressed air to be distributed at will, at a low or high temperature, in the reservoir formed by the cap. An air-purging cock is also placed upon the cap, which fits the mould hermetically. A first "cleare" is introduced in the space, the air of which escapes by the purging cock, which is then closed, as well as that through which the "cleare" has been introduced. Tepid compressed air is then admitted, which presses upon the "cleare," which is also sucked or drawn through the sugar by a lower cock, in connection with a pump, and the operation is then repeated. When the clarifying is considered sufficient the drying is proceeded to, without changing the place of the mould. For this purpose the compressed air is heated by suitable means, and led by an arrangement of cocks and valves into the space in the mould; and after the current of hot air has been maintained for some hours the sugar loaf is white, dry, and sonorous, and is ready to be put under cover after a slight

cooling. The air is compressed by the same pump which forms the suction cock vacuum. The discharges are received in a reservoir which is in front of the said pump, and whence they are drawn out or raised at desired intervals, by the aid of steam or otherwise. The air employed is filtered, so as to produce white sugars.

2090. CHARLES HAUGHTON GILL, 6, Christian-street, St. George's-in-the-East, Middlesex. *Improvements in apparatus for moulding and pressing sugar.* (A communication from abroad, by Robert Pzillas, of Brieg, Germany.) This invention relates to apparatus whereby granular sugar is moulded and pressed into the form of elongated prisms, or other shapes convenient for its being broken into cubes or other suitable forms. The apparatus for this purpose consists of two main parts—the one part for effecting the feed, the moulding, and the pressing of the sugar; and the other part for moving successive boards to receive the moulded blocks, and carry them onwards to a convenient position for their removal. It is to be understood, however, that the moulding and pressing portion of the apparatus might be used alone; the supply of boards, and their removal when the moulded blocks are lodged on them, being effected by hand or otherwise. In the moulding and pressing part of the apparatus there is a hopper, which is supplied with the granular sugar, and which has in its lower parts two toothed rollers, revolving so as to agitate the sugar and direct it down to the lower mouth of the hopper. This mouth is fitted with a sliding plate, bevilled to a chisel edge, and moved alternately backwards, so as to leave beyond its edge a passage for sugar from the hopper into the mould below; and forwards so as to close the mouth of the hopper and form a cover for the mould. The bottom of the mould is a plate fixed below the said slides, at a distance corresponding to the depth of the block to be moulded; the front side of the mould is a plate, which is made to slide vertically; and the back of the mould is a piston or plunger, sliding horizontally between the bottom and cover of the mould. The moving parts of the mould are worked from cams on the main shaft of the machine, timed so as to effect the moulding and pressing of the sugar, as follows:—The plunger being retracted, and the front plate of the mould being raised, the hopper slide is drawn back, so that a charge of sugar descends from the hopper on to the bottom of the mould. The hopper slide is then closed and the plunger advances, compressing the charge of sugar, whereupon the plunger remains for a time at rest. The front plate then descends, and the plunger advancing farther pushes the moulded block on to the movable part of the bottom, and rests; and the movable part of the bottom then receiving a slight movement upwards causes the moulded block to slide off the face of the plunger, which thereupon retreats. The plunger having retreated, and the front of the mould having risen up behind the

block already moulded, the action is repeated, a fresh block being advanced by the plunger, so as to push forward the block previously formed on to a board placed for its reception. And thus, successively, block after block is moulded and pressed and advanced on to boards, on which they are removed to dry and harden. The face of the plunger, or the bottom or front of the mould, may be provided with thin projecting plates, so as to divide the sugar into separate cubes or portions of its length; but it is preferred to make such divisions only partial, so as merely to weaken the block at points of its length, where it can afterwards be readily broken across into separate fragments. To the above moulding and pressing apparatus may be applied automatic apparatus for placing the boards for the reception of the moulded blocks, and for moving them away as they become charged therewith.

#### BELGIAN.

43672. LECOINTE and VILLETTE. *A preparatory best-pulp press.*

#### FRENCH.

117874. BRISSONNEAU BROTHERS and LAHAYE. *Improvements in the treatment of sugar cane, and in apparatus belonging thereto.*

117925. CARTIER, of Moulins. *A sugar cutter.*

117982. BRISON, JUNR. *A system of reviving spent black of sugar works.*

117984. PIÉRON. *Purifying syrup and molasses by means of cold.*

117999. MATTHIESSEN and GOUBERT. *Improvements in apparatus for the manufacture of sugar.*

118037. CARTIER. *A sack chariot for sugar works.*

118136. DE MÉRITENS. *Defecating, refining, and purifying molasses.*

118168. THE PRAGUE ENGINE WORKS COMPANY. *A continuous apparatus for extracting best juice.*

118372. MEHAY. *The osmotic purification of sugar syrup and other substances containing different elements that may be separated by osmose, and apparatus belonging thereto.*

118385. DE MÉRITENS. *Decolouring and refining sugar.*

118451. DE MÉRITENS. *An apparatus for concentrating and boiling sugar juice and all solutions.*

118480. MESSRS. LOEWIG. *Clarifying cane juice.*

111857. CASALONGA. *Manufacturing sugar.* (Addition.)

116013. BATAILLE. *A best-pulp clearer.* (Addition.)

91970. LEDUC BROTHERS. *A sugar cutter.* (Addition.)

114510. REYNOSO. *Improvements in the treatment of sugar cane, and in apparatus belonging thereto.*

114823. DERUE. *Preserving the juice of beetroot, potatoes, &c.* (Addition.)

## AMERICAN.

197831. G. L. G. DESIGNOLLE, of Paris, France. *Improvement in artificial animal black.* The characteristic feature of this product, the manufacture of which is the subject matter of this invention, is its absolute identity with the black which proceeds from the burning or calcining of bones. This identity is not only one of chemical composition and physical properties, but extends to the immediate principles, the transformation of which creates what is well-known as "bone black." Both the mineral and organic substances, the mixture of which constitutes the prime matter of this absorbent, and decolourizing coal are perfectly analogous in every particular with those which compose animal black. The principle upon which this invention is based is, that all kinds of leather may be rendered isomeric with osseine, and thus replace that substance as a source of animal black. All kinds of green skins or leather, or leather and clippings, and wastes of tanned leathers, such as are found in tanneries and elsewhere, have been employed with equal success. As to the mineral portion of the bones, only two appear to have any importance as affecting the absorbent properties of blacks, and those are the phosphates of lime and magnesia, having three equivalents of base for one of acid. Claims:—1. In the manufacture of artificial bone black the process of supplying a carbon-producing ingredient by subjecting leather clippings, or other analogous substance, to the action of caustic soda solution under heat and pressure. 2. The process of manufacturing artificial bone black, consisting of mixing a gelatine magma with bibasic phosphate of lime and neutral phosphate of magnesia, and calcining the mass until charring is completed. 3. An artificial bone black in which the proportions of the phosphates are varied according to the purposes for which the black is to be used.

WILLIAM B. ATKINSON and HENRY C. ATKINSON, of Franklin, Kentucky. *Improvement in evaporating pans.* The object of this invention is to construct a cheap and serviceable evaporating pan, capable of being repaired easily when a part of its bottom becomes burned. The metal portion forming the bottom and divisions is made in sections of equal lengths. These sections extend the full width of the pan. Each section is locked, one to the other, by having their alternate divisions overlapping each other. The sides of the said evaporator are of wood, and are drawn tightly against the ends of the aforesaid sections by means of nuts or rods, which extend across the under side of the pan through a supporting strip, and through the sides, and terminating outside arched springs, against which the heads and nuts have their bearings. The rods on the outer ends of the pan extend through the sides about on a level with the tops of the divisions.

ISAAC A. HEDGES, of St. Louis, Missouri. *Improvement in mills for grinding cane.* The mill is provided with a feed-roller, crushing-roller, and delivery-roller, all vertical and triangularly arranged between an upper and lower housing. The openings for the roller or cylinder shafts in the lower plates are surrounded with annular ledges or equivalent device so constructed as to effectively separate the cane-juice from the oil used to lubricate the cylinder shaft. In the lower ends of the rollers are recesses corresponding to the annular ledges, and in which the ledges fit; and in the upper end of the rolls are recesses into which the corresponding ledges on the bottom side of the upper plate may fit. Around or next the outer edge of the lower housing is constructed a flange or ledge, which prevents the juice from escaping over its edge. This housing is thus made a receptacle, in which the juice is collected to be conveyed off through a spout or suitable opening for that purpose. In combination with the feed and crushing roller is provided a regulator and adjuster, being an oblong throat extending longitudinally with the said rollers, and of a width just sufficient to accommodate as much cane as should be permitted to be fed to the rollers at one time. In order to admit of lubricating the lower journals and gearing of the mill, tubes or openings are made to communicate between the upper end of the rollers and the journals and gearing: thus the more remote parts of the mill may be lubricated without removing the rollers. A pair of corrugated cylindrical shells or sleeves is constructed of such internal and external dimensions in reference to the diameter and central distances of one pair of the crushing-rollers, that they may be conveniently slipped over the latter and retained in place; the mill is thus converted into a corrugated mill.

### SUGAR STATISTICS—GREAT BRITAIN.

TO JANUARY 19TH, 1878 AND 1877. IN THOUSANDS OF TONS, TO

THE NEAREST THOUSAND.

	STOCKS.		IMPORTS.		DELIVERIES.	
	1878.	1877.	1878.	1877.	1878.	1877.
London ....	95	53	16	14	17	13
Liverpool ..	29	24	9	15	11	8
Bristol ....	3	3	4	3	2	3
Clyde .....	44	19	16	8	12	7
Total ..	171	99	45	40	42	31
Increase..	72		5		11	

STOCKS OF SUGAR IN THE CHIEF MARKETS OF THE WORLD ON THE  
1ST DECEMBER FOR THREE YEARS, IN THOUSANDS OF  
TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1877.	TOTAL 1876.	TOTAL 1875.
161	149	11	77	2	400	291	370

CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING  
1ST DECEMBER, IN THOUSANDS OF TONS.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1877.	TOTAL 1876.	TOTAL 1875.
863	278	32	266	152	1591	1639	1537

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE,  
FOR THE ENSUING SEASON, COMPARED WITH THAT OF THE THREE  
PREVIOUS SEASONS.

(From *Licht's Monthly Circular*.)

	1877-78.	1876-77.	1875-76.	1874-75.
	Tons.	Tons.	Tons.	Tons.
France .....	360,000 ..	243,295 ..	462,259 ..	450,877
Germany (Zollverein) ..	365,000 ..	291,204 ..	346,646 ..	250,708
Austro-Hungary ....	245,000 ..	205,267 ..	180,138 ..	140,192
Russia and Poland ..	250,000 ..	250,000 ..	245,000 ..	222,500
Belgium .....	65,000 ..	44,467 ..	79,796 ..	71,079
Holland and other Countries.....	25,000 ..	25,000 ..	30,000 ..	30,000
Total.....	<u>1,310,000</u>	<u>1,059,233</u>	<u>1,343,839</u>	<u>1,165,356</u>

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STATE AND PROSPECTS OF THE SUGAR MARKET.

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The commencement of business after the holidays was marked by a slight advance in the price of sugar, but since then lower prices have ruled; and the month closes with an advance of about 6d. per cwt. on useful refining sugars, whilst the finer kinds of raw sugar are hardly altered in price.

The imports of sugar in 1877, as compared with 1876, showed an increase of about 66,000 tons, whilst the deliveries showed a decrease of about 57,500 tons. The stocks at the end of the year were 81,309 tons in excess of those held at the same period in 1876.

The year commences with an apparent revival of the arrested consumption of sugar, caused by the high prices at the close of 1876 and during a considerable part of 1877; the increase during the first three weeks of the year being 11,000 tons, as compared with the corresponding weeks in 1877. Stocks of sugar on the 19th January were 72,961 tons in excess of those held at the same time in 1877. Raw beetroot sugar is quoted about 1s. higher than at the close of 1877.

On the whole, we think the position more favourable for planters, though the maintenance of present prices is all we can anticipate at present.

Present quotations of the standard qualities are as under:—  
Porto Rico fair to good refining, 21s. to 21s. 6d., against 21s. to 21s. 6d.; good to fine grocery, 22s. 6d. to 25s., against 22s. to 24s.  
Martinique crystals, 27s. 6d. to 28s., against 28s. to 29s.; No. 12 Havana, 23s. to 23s. 6d., against 22s. 6d. to 23s.; fair to good refining Cuba Muscovados, 21s. 6d. to 22s., against 21s. to 21s. 6d.; middling to good brown Bahia, 18s. 6d. to 19s., against 18s. to 18s. 6d.; good to fine Pernambuco, 19s. 6d. to 20s. 6d., against 19s. to 20s.; Paris loaves, 27s. 9d., to 28s. 6d., against 28s. to 28s. 6d.

# THE SUGAR CANE.

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No. 104.

MARCH 1, 1878.

VOL. X.

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 The writers alone are responsible for their statements.

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## THE SUGAR QUESTION.

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There are many indications that the fiscal questions connected with sugar, which have for long attained to a position of international importance, will not remain much longer in their recent state of suspense. The political crisis in France has now passed away, the new Dutch Ministry has been sufficiently long in office to be able to take up the question, and although our Foreign Office is absorbed in matters of high State policy, it fortunately possesses a separate Commercial Department, ready at all times to carry on negotiations connected with international trade questions, and especially at liberty to deal with sugar now that the French Commercial Treaty has passed for a time into a state of abeyance. It is impossible that a question which has involved the holding of five International Conferences in the last six years, and which is still unsettled, should remain long in the background, and there is no doubt that it would long since have been brought to some conclusion had it not been for the unfortunate political confusion in France during the greater part of last year, followed by a change of Ministry in Holland. The official inquiry in France in 1872, the lively debates in the National Assembly in 1873 and 1874, the important vote of March, 1874, establishing refining in bond in France, the subsequent evasions of the French Government, the final acceptance by it of refining in bond, resulting in a draft treaty on that basis in 1875, the acceptance of that treaty by the



French National Assembly and the Belgian Chamber of Representatives, and its rejection by the Dutch Chamber, followed by a vote of that Chamber equivalent to a retraction of its former decision, are events which sufficiently show the importance of the questions discussed and of the interests at stake. Two elaborate and protracted Conferences have followed these events, and refining in bond has, in consequence, become still more firmly established as the only true system, and the sole one on which an agreement can be come to. It will be recollected that in the autumn and winter of 1876, at a time when hopes of a settlement of the sugar question began to flag, a combination of French Deputies and Senators was formed, whose efforts resulted in the important Conference of last spring. The kind of stimulus then applied to the French Government is very likely to be renewed in a similar manner at the present time, if political animosities will permit of Deputies and Senators acting together on the neutral ground of commercial policy. An important letter in the *Journal des Fabricants de Sucre*, of the 20th ult., points out that the necessary modifications in sugar legislation ought to form the leading subject of discussion at the approaching meeting of the central committee of sugar manufacturers. The writer says that the fact of the laws already voted by the National Assembly having been disregarded is a scandal still fresh in everyone's recollection. While commercial treaties have become the order of the day, are decisions with respect to sugar, he asks, to be taken in the silence of the Cabinet, by men whose opinions are already too well known? While a Commission of Enquiry as to the causes of commercial depression is busy with its labours, not a word is said about sugar. Why does not the Central Committee lay its complaints before this Commission? Why does it not announce that it is about to reconstitute the extra-Parliamentary combination of Deputies and Senators? The accidental fact that the beetroot has this year given an unusually high yield can be no sufficient reason against doing so. If political differences stand in the way of further action by means of such a combination, he urges that they should hasten to remove them, calling to mind the bene-

ficial results of the former extra-Parliamentary inquiry, at which the refiners found it difficult to conceal the manœuvres and dodges by which they succeed in slipping into their own coffers the enormous sums which ought to go to the public treasury. Why not go to the Budget Commission and state the position of the sugar industry, he asks, and explain, for instance, how the system of *osmose*, as practised by the refiners, sends into consumption, *incognito*, considerable quantities of refined sugar free of duty. That Commission, if thus enlightened,—and every day proves that it is anxious for information—would find that sugar is a product as worthy of their interest as soap or lucifer matches. He thinks that any political ill-feeling ought not to prevent the representatives of the sugar districts from deliberating with the Commission.

The Editor, in commenting on this letter, makes some remarks which we are glad to see, as he was disposed a few weeks ago to misinterpret and therefore misrepresent our observations in connection with the deficit in the French revenue returns from sugar for the past year. We strictly confined ourselves to pointing out that although this may partly be explained by a falling off in consumption, it must also be attributed to the mode of assessment, whereby the refiner intercepts a portion of the duty. The *Journal des Fabricants*, although disposed at first to call in question this view, has now, in its leading article of the 20th ult., fully confirmed it. The writer says: "We have ourselves a short time ago, with reference to the deficit in the receipts from sugar in 1877, sufficiently pointed out that we must not lose sight of anything in connection with the duty and its mechanism. We know, in fact, that this deficit was 23 millions as compared with the preceding year, and 25 millions on the budget estimates. Where are those 25 millions? To seek for the 25 millions is the enigma which, to use a figure of speech much in vogue, we are permitted to put, and to which it is of the highest interest that an answer should be given. What influence has the manifest diminution in consumption had on this great deficit, and what has been the no less certain influence of the legislation of

"1876, permitting, under the bastard system of categories, a continuation of the abuses which were to be suppressed? If a part of the 25 millions is in the pockets of the refiners, as some affirm, what means are there of preventing the money of the taxpayer from taking this direction under the vain pretext that its presence in that quarter is a useful stimulus to exportation."

These remarks were called forth partly by the letter referred to above, and partly by a circular addressed by their secretary to the members of the Central Committee of French Sugar Manufacturers, calling their attention to the difficulties which are daily occurring between the revenue authorities and the manufacturers on the one hand, and between these latter and the refiners on the other, as to analysis and classification. The committee is informed that this subject will be brought forward at its approaching session, and the members are requested to collect all the information possible in regard to it, in order to facilitate the investigation. From this it will be seen that there is every reason to hope that a fresh exposure of the anomalies in the French system of sugar duties will shortly take place, which must, as on former occasions, be followed by discussion of the matter in the French Chambers, and a consequent re-opening of the international negotiations.

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### THE SUGAR TRADE OF THE UNITED STATES.

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It is satisfactory to find, now that the accounts for 1877 have been made up, that the consumption of sugar in the United States has not fallen off. It had been anticipated—and indeed the weekly returns tended to confirm the fear—that the high prices of last winter and spring would seriously affect the deliveries. In the United Kingdom the difference between 1877 and 1876 amounts to 57,000 tons, in France the deficiency is about 30,000 tons, and in Germany 48,000 tons. In the United States, on the contrary, the deliveries of foreign and home-grown sugar amounted last year (not including the Pacific States) to 666,000 tons, an excess of 7,800 tons over the previous year. The deliveries in 1876 were, however, less by 27,000 tons than those of 1875. The quantity

of home-grown sugar in 1876-7 is estimated at 89,000 tons, against 77,000 tons in 1875-6. The fear of a sugar famine had so seized upon the minds of the trade at the beginning of the year that America appeared as a buyer in all quarters; and the result has been that they actually imported 54,000 tons more sugar last year than in 1876. The consumption, though satisfactory, has remained nearly stationary since 1871. In that year it amounted to 633,000 tons, which was an excess of 100,000 tons over the preceding year, and of 230,000 tons over 1867. But since 1871 the consumption has only fluctuated between the narrow limits of 650,000 and 700,000 tons.

If we include the Pacific States, the sugar made from molasses, the maple, sorgo, &c., the total consumption of the States stands as follows:—

	Tons.
Atlantic States .....	666,194
Pacific States .....	29,556
Molasses sugar .....	35,500
Maple sugar .....	12,000
Sorgo, &c. ....	2,000
Total, 1877 .....	745,250
Against, 1876 .....	745,269
The exports of refined in 1877 were.....	38,911
Against, 1876 .....	24,301

It was time, therefore, that the export bounty, which was increasing the exports at the rate of 50 per cent. per annum, should be checked.

### THE SUGAR DUTY IN AMERICA.

A scheme for a new scale of duties has been drawn up by importers, refiners, and others interested in the trade in New York, and submitted to the trade of Baltimore, Boston, and Philadelphia, for their approval. A deputation has also been appointed to proceed to Washington and present the scheme to

the Committee of Ways and Means. The plan combines a reduction of duty with a partial substitution of assessment by polarization for assessment by colour. It is, briefly, as follows :—

	Cents per lb.
Concrete, syrup, cane-juice, melado, molasses, &c., and all sugar not above No. 13 D.S. in colour, and below 80 per cent. polarization .....	2
Between 80 and 86 per cent. ....	2·3
„ 86 „ 92 „ .....	2·55
Above 92 per cent. ....	2·8
All sugar between Nos. 13 and 16 .....	3·05
„ „ 16 and 20 .....	3·4
„ Above No. 20 .....	4
Molasses below 55 per cent. polarization ....	6½ cents per gallon.

The great difference between the rates on sugar below No. 13, and those on sugar above that colour is stated to have been adopted with due regard to the production of domestic sugar. It is evident, therefore, that the scale on sugars below No. 13 is the only one which will concern the refiners. This scale is open to numerous criticisms, but it is of little use to analyse it until we know what drawback it is proposed to allow on refined sugar exported.

### VISIBLE SUPPLY OF SUGAR.

FEBRUARY, 1878.

Stocks.	1878.	1877.	1876.
	Tons.	Tons.	Tons.
Great Britain .....	170,929	100,813	150,085
France .....	170,000	172,538	234,944
Holland .....	32,056	10,322	15,988
Germany .....	90,225	45,800	61,675
United States .....	44,536	13,305	35,000
Havana and Matanzas.....	15,465	14,142	23,233
Afloat .....	81,496	92,247	85,000
	604,707	449,167	605,925

Though the above is a tolerably complete statement, it is, as usual with such statistics, deficient on some points. For instance, no account is taken of stocks in Austria and Russia, two large sugar-producing countries. A curious anomaly exists with respect to the American statistics. The figures given as representing the stock in the United States do not include direct imports by the refiners, which now constitute a large proportion of the total stock. Again, there is a considerable quantity of sugar afloat, which never appears in any of the lists. A large part of the shipments from the British West India islands is not taken into account. Those from all the ports in the island of Cuba, except Havana and Matanzas, are not given. Porto Rico is entirely ignored. So are the French islands. According to the Board of Trade returns, we imported last year 151,449 tons from China, Peru, and other countries. These shipments do not appear in the estimate of quantities afloat, though Peru is now one of the principal sources from which Liverpool derives its permanent supply of sugar.

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#### QUESTION IN THE HOUSE OF COMMONS.

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On the 22nd ult., Mr. Wait asked the Under Secretary of State for Foreign Affairs, whether any progress has been made in the ratification of the Convention on Sugar Bounties, agreed to by delegates of the four Contracting Countries nearly a year ago; or whether, the time stipulated for ratification having long since expired, Her Majesty's Government propose to renew negotiations for the abolition of bounties on the export of sugar from France, Belgium, and Holland, and to include in such negotiations Austria, and Russia, where also large bounties are given:

And, whether Her Majesty's Government have received any further complaints of the operation and extension of the foreign bounty system on account of increasing injury thereby inflicted on the British colonies.

Mr. Bourke, in reply, said:—The Netherlands Government raised objections to the terms of the draught Convention prepared last

year by the delegates of Great Britain, Belgium, France, and the Netherlands. Communications are still passing between the four Powers with the view to the signature of a fresh sugar Convention; and Her Majesty's representatives continue to take such steps in the matter as they properly can. There is no reason to think that the Governments of Austria and Russia would be willing to join the four Powers in the proposed Sugar Convention. The West India Committee has continued to call the attention of Her Majesty's Government to the injury occasioned to the West India sugar colonies by the Foreign bounty system.

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## PRACTICAL OBSERVATIONS ON MILLS, AND ON THE EXTRACTION OF JUICE FROM THE SUGAR CANE.

Written for the Ponce (Porto Rico) Agricultural Society, by

ROBERT GRAHAM, Esq.

And translated from the Spanish for the *Sugar Cane* by Mr. Gust? Cabrera.

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The extraction of the juice from the sugar cane is an important operation—perhaps the most so—in the manufacture of Colonial sugar. Sugar planters, traditionally indifferent, have been satisfied till now with a yield of 50 per cent., more or less, of the juice of the canes, literally throwing away every year more than a third of their crop. If I say *one third*, it is because we cannot obtain all the juice of the cane by pressure alone.

Competition with beetroot sugar, to which these gentlemen have been subjected for some years past, has at last opened their eyes on this ruinous process, and, accordingly, something has been done, though in an isolated way, in this colony, as well as in others, to put a stop to the evil.

The progress made consists, principally, in the introduction of more powerful mills and engines, which have considerably reduced the loss on several estates; but power alone in the engine, and mill that is to grind the cane, is not enough. If we wish to obtain the largest possible yield, other conditions are required besides power.

The most powerful engines that I have seen grinding canes are those on the estates "Versailles," in Demerara, and "Sainte Madeleine," in Trinidad. They were 65 horse-power, or 30 per cent. more powerful than Mr. D. Palmieri's on the "Amelia" estate, in this district, which is one of the most powerful in the Island. The yield on those estates, nevertheless, did not exceed, according to my observations, 70 per cent. of the weight of the canes.

If we want to extract the utmost juice by means of pressure, we must bear in mind the following four conditions, which should regulate the working of the machinery:—1st, power; 2nd, proportion; 3rd, velocity in the rollers; 4th, uniformity in the layer of canes passing between the rollers.

I have nothing to say regarding the first, as we are all convinced that there is always a great loss in the use of weak machinery, and very little with regard to the 4th, about which we all, more or less, agree. I would, nevertheless, say that, although the latter is the simplest and easiest to fulfil, it is the one least attended to. The overseer's attention is engrossed with having enough juice to keep his battery occupied, and with making the greatest number of hogsheads per day; the mill may be working too slowly or too rapidly,—the cane carrier may be well or badly loaded,—he does not care; everything goes well if the supply of juice does not fail. A mill is good or bad, for an overseer, according to the amount of canes it crushes; he never troubles his brains about extraction. This is a great mistake, to which, in a great measure, the losses caused by a bad extraction may be attributed. I believe that the first duty of the overseer should be to obtain the utmost yield from the canes he is grinding.

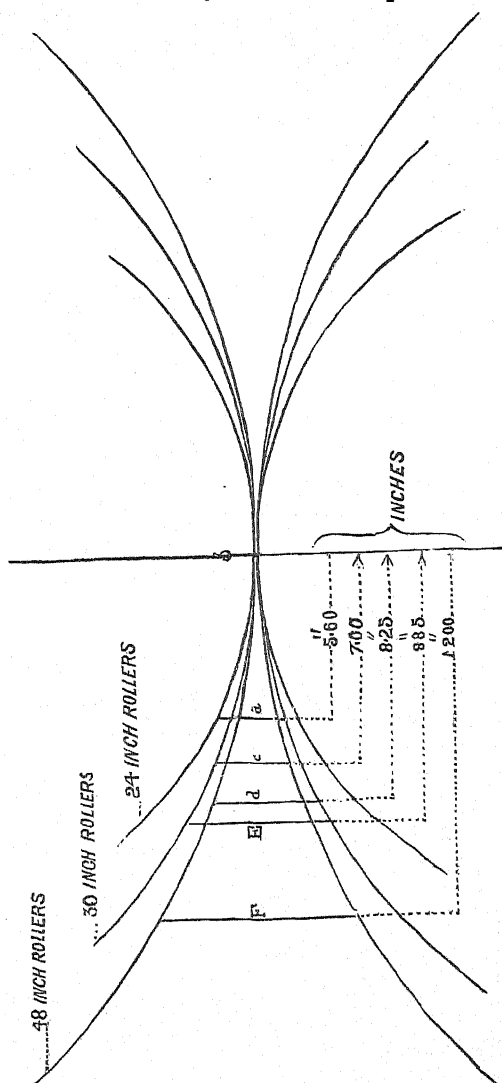
I have now to call your attention to the second and third conditions—those which regard proportion and velocity—about which we do not see the same unanimity of opinion. There are, or there have been, persons who preferred long rollers of small diameter and great speed, believing that, with a long surface and quick movement, a greater pressure would be exerted,—the layer of canes being a thin one. Practice soon exploded the error of those who thought so. These gentlemen did not see that with long rollers it was very diffi-



cult to get the whole surface of the cane carrier equally loaded with canes, and that this difficulty was rendered still greater by the layer of canes being a thin one. They did not see that the speed of the rollers must be in proportion to the time required by the juice, after being pressed from the cane, to separate itself from the megass. If we examine the megass from a powerful mill, we will see that it has been subjected to an enormous pressure, 'reducing it to powder,' and yet, if we examine it properly, we will see that it contains from 20 to 40 per cent. of the juice of the cane. The cause of this is, not the want of pressure, but the shortness of the time during which it lasted. All the juice in the cane is indeed liberated, on the cane being subjected to the strongest pressure, but only its bulkiest part can make its way to the gutter under the rollers, on account of the brief period during which the pressure lasts,—on account of the friction and contrary movement of the rollers,—and on account of the canes that block the outlet. The megass, immediately on being freed from pressure, turns itself into a sponge, and absorbs the juice that has been unable to find its way to the gutter. This will happen, more or less, according to the speed of the rollers; in some mills the speed is such that we can see the juice carried away by the megass. In order to obtain a good yield, it is, therefore, evident that the pressure ought to last as long as possible. This can be best secured by combining in the rollers a slow speed and a great circumference.

The triangular prism formed by two circles, when their circumferences touch each other, is more or less acute in proportion to the diameter of the circles. Plainer still, in order to fill the angle formed by the two circumferences, a wedge 3 inches in breadth should be 5.60 inches long in rollers 24 inches in diameter; 7.08 inches long in rollers 36 inches diameter, and 8.25 inches in rollers 48 inches diameter. This will prove the superiority of large diameters in rollers. Their superiority, however, is not only on account of the larger pressing surface they show, but, above all, on the greater thickness of the layer of canes they can receive; and, on both these sources of superiority being added together, we see that they increase the pressing surface more than 100 per cent. This will be

better understood by referring to the annexed diagram, which shows the pressure to which the cane is subjected from its entrance into mill through the top and cane rollers, to its exit through the top and megass rollers,—that is to say, the mill's total pressure.



The pressing surface, which begins in A, and ends in B, in 24-inch rollers, is 5.60 inches. The pressure, with the same layer of canes, in rollers 36 and 48 inches in diameter, would begin at C and D, which are 7 inches and 8.25 inches distant from B, showing an increase of 25 per cent., in pressing surface, for 50 per cent. increase in diameter, and an increase of 47.35 per cent., in pressing surface, for an increase of 100 per cent. in diameter. But, as the thickness of the layer of canes should increase in proportion as the diameter of the rollers augments, the pressure, beginning at A, in 24-inch rollers would begin in 36-inch ones at E, which is 8.35 inches distant from B, showing 58 per cent. increase of pressure for 50 per cent. increase in diameter. In 48-inch rollers, the pressure begins at F, 12 inches from B, giving 118 per cent. increase, in pressure, for an increase of 100 per cent. in diameter.

We will now consider what would be the result of a reduction of speed, which in modern mills is generally 18 feet per minute.

The pressing surface in a 24-inch roller is 5.60 inches, and the pressure, with a speed of 18 feet per minute, lasts 1.5 seconds. If the speed is diminished 50 per cent.—to, say, 9 feet per minute—the pressure is augmented 50 per cent., or to 3 seconds in a 24-inch roller. In a 36-inch one, the pressure with the same speed will last 4.91 seconds, equivalent to an increase of 327 per cent. In a 48-inch roller, the pressure would last 6.66 seconds, equal to an increase of 444 per cent.

Adding these various augmentations of pressure, their result, as compared with those of a 24-inch roller, at a speed of 18 feet per minute, would be as follows:—

50 per cent. increase in the diameter is equal to an increase in pressure of .....	58 per cent.
50 per cent. less speed is equal to an increase in pressure of.....	327   ,,
Total increase in 36-inch rollers.....	<u>385</u> ,,
100 per cent. increase in the diameter is equal to an increase in pressure of .....	118 per cent.
50 per cent. less speed is equal to an increase in pressure of.....	444   ,,
Total increase in 48-inch rollers.....	<u>562</u> ,,

In other words, if, in 24-inch rollers, with a speed of 18 feet per minute, the pressure is equal to 1,—in 36 and 48-inch rollers, with a speed of 9 feet per minute, the pressure would be 3·85 and 5·62, or nearly treble in the 36-inch rollers, and nearly five times greater in the 48-inch rollers.

Rollers of a large diameter have another advantage. They allow a greater resisting power, in proportion to the axles, mill checks and bolts, thus augmenting their rigidity. This, under equal circumstances, produces a greater pressure. I have seen, and you certainly have also seen, the rollers tightened down by means of a long levered key, managed by four men, and yet, on the mill being well fed, the top roller was raised about one-fourth of an inch; and this is equal to a very considerable loss in pressure. This is caused by the flexibility of the axles, on one side, and by the length of the bolts on the other. This can only be avoided by increasing the size, and, consequently, the resisting power of these parts.

In short, the advantages of this mode of construction are the following: By the diminution of the speed we allow the juice to run free from the megass before the pressure is over. A large diameter in rollers will give us a larger pressing surface, will admit of a thicker layer of canes being ground, and will allow a greater solidity to be given to the axles, &c. Short mills require narrower cane carriers than long ones, and facilitate their being fed with greater regularity; the cane carrier's axles, being shorter, are less flexible. In grinding a thick layer of canes a slight imperfection in feeding the mill is not very important, as canes being, so to say, a semi-solid, they spread under the pressure, and fill all the empty places between the rollers.

Proportion and speed in mills have their limits, as everything else has. After many years of practice in grinding canes, and after many experiments which agree with those of other gentlemen interested in the extraction of juice from the sugar cane, I have been enabled to lay down the following rules for constructing machinery with that end:—

- 1st. The rollers must not have a speed above 9 feet per minute.
- 2nd. The engine's piston should have an average speed of 240

feet per minute. This speed will allow the use of very powerful toothed wheels.

3rd. The average pressure in the boiler should be 40 lbs., if steam is admitted into the cylinder during all the stroke of the piston. If steam is cut off at half the stroke, the rest being done by its expansion, then the average pressure in the boiler should be 60 lbs.

All the proportions requisite to obtain the greatest possible and practical yield by pressure flow from these three fixed rules, viz.:—

1st. To press one gallon of juice per minute,  $1\frac{1}{4}$  nominal horse power is necessary.

2nd. The piston's stroke is the cylinder's diameter  $\times 2\frac{1}{4}$ .

3rd. The roller's diameter is the cylinder's diameter  $\times 2$ .

4th. The length of the rollers is their diameter  $\times 1\frac{1}{4}$ .

5th. The average thickness in the layer of canes entering the rollers is 25 per cent. of their diameter, the speed of the rollers and cane carriers being the same, and the canes well distributed on the latter.

6th. The opening between the two receiving rollers is 10 per cent. of the thickness of the layer of canes.

7th. The opening between the top and the megass rollers is 10 per cent. of the other opening.

These formula, as I have previously stated, are the result of a great number of experiments, during a long series of years of constant contact with the manufacture of sugar.

These rules, the three fixed ones excepted, are not absolute, and may be altered somewhat, without diminishing the extraction. According to these rules, for example, we would require a 50 horse power engine, with cylinder 22 inches diameter by  $49\frac{1}{2}$  stroke, and rollers 44 inches diameter and 66 long, to make 15 tons of sugar or 24 Porto Rico hogsheads per day. But, in order to have fuller dimensions, the engine may be 50 horse power, with cylinder of 22 inches diameter and 48 stroke, and rollers 42 by 66, and so on, always endeavouring not to diminish its power.

The proportions which should be observed, in order to obtain the

greatest possible yield, when making about 15 tons of first sugar per day, would be as follow :—

Speed in piston, per minute.....	240 feet.
Diameter of ditto .....	22 inches.
Stroke .....	48 ,,
Diameter of rollers .....	42 ,,
Length of ditto.....	66 ,,
Speed of ditto per minute .....	9 feet.
Thickness of layer of canes in cane carrier (with same speed as rollers) .....	11 inches.
First opening between rollers .....	1·1 ,,
Second ditto ditto (outlet) .....	0·11 ,,

The yield, in mills working under these circumstances, is not less than 75 per cent. of the weight of the canes, and probably more when grinding soft juicy canes.

As a practical example of this I can point to the engine and mill at the "Restaurada" estate, in the district of Ponce, belonging to Mr. Miguel Arribas. Its proportions are those mentioned above, excepting the rollers, whose diameter is 36 inches, and the cane carrier, whose speed is somewhat greater.

The yield obtained in this mill, when pressing 2100 gallons juice, 11° Beaumé, per hour, was 77·61 per cent. of the weight of the canes, as will be seen by the following table, taken from the account books of that estate :—

Cart loads.	Lbs. Canes.	Galls. Juice. 11° Beaumé.	Lbs. Juice.	Lbs. Sugar.	Lbs. Molasses	Total Saccharine Matter.
Cart loads.. 629	1,369,275	98,350	1,063,163	138,750	64,944	203,694
" .. 1	2,177	156·36	1690·25	220·60	131·67	352·27
Pounds .... 100	100	7·18	77·61	10·13	4·74	14·87
Gallons .... 1	13·92	1·00	10·81	1·41	0·66	2·07

Our canes have, as an average, 13 per cent ligneous matter and 87 per cent. juice. It is practically impossible to extract all the juice of the cane, but between the present extraction in this island, which is about 60 per cent. of the weight of the canes, and the yield of the few well-constructed mills, now working, there is a loss of

from 15 to 20 per cent. This is no trifle in a crop of, say, 1000 hogsheads.

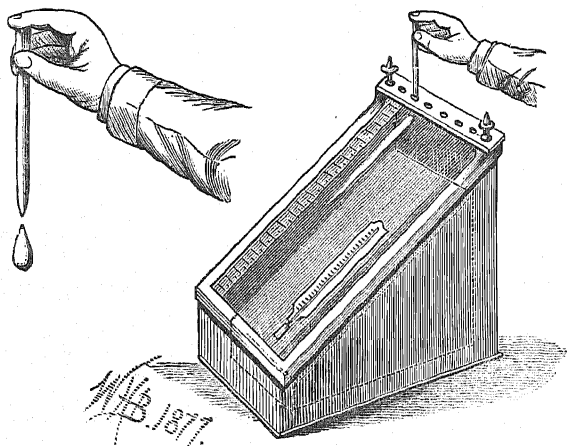
I should perhaps say something, before finishing, on the different methods of extraction, such as diffusion, double mills, and maceration; but the information that I have been able to collect now and then, and during my visit to Trinidad and Demerara in 1874, where much has been done to improve these methods, leads me to the conclusion that they are not an improvement as compared with the plainer and more economical one of a well-constructed three-roller mill. It would, therefore, be useless to take up your time now with this subject.

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### TESTING THE VALUE OF LUBRICANTS.

*Continued from page 95.*

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WARM GLASS TEST FOR FLUIDITY OXIDATION.—Fig. 5.

The diagram shows a ready method I have designed for testing oil in this way. It consists of a tin box in which is fixed the glass, through which can be seen a thermometer. A graduated scale at the side of the box enables the track of the oil to be measured. The box has a door at the back which enables a copper

vessel full of boiling water to be introduced; the box is lined with felt to prevent rapid radiation, and when the door is closed it will be seen that several experiments may be conducted before the apparatus becomes too cool for use. I think this is a cleaner way than using a lamp for the purpose. The copper may also be used by itself for indicating the behaviour of oil on copper when slightly warm in making it discoloured or otherwise. As I have before stated, there are many oils which are good lubricants but which become too thin when exposed to slight heat, and I do not hesitate to reiterate the statement, as I wish it to have some influence on the future designs of bearings in this district.

In to-day's "*Engineer*," a correspondent writing from Queensland, says, that for six months in the year oil runs off the machinery like water, and seems to have no lubricating power; he says that the thermometer registers in the summer 140 degrees in the sun and 110 degrees in the shade; great difficulty seems to have been experienced by him in keeping oil on the bearings, his experiments on locomotives show that it costs, for lubricating a locomotive there, about one halfpenny to three farthings a mile, according to the mixture used.

#### *Influence of the Atmosphere on Oils.*

There are some oils which are excellent lubricants for the first few hours of use, but which have a low capacity for resisting the influence of the oxygen of the atmosphere upon them. The warm glass test may be used for indicating this weakness, if, after the test for fluidity, the oil be permitted to remain on the glass, any exhibition of a resinous or varnish quality may be observed.

Another test for this resinous or gummy quality is one which has been suggested to me by Mr. F. R. Wheeldon, of Bilston. He has made many experiments. He found that by permitting oil to remain on a Stapfer friction tester after one test, which had been recorded, he tested again on the following day without adding any fresh oil. This is a severe test, as the thermometer was made to indicate 200 degrees Fahrenheit each time. The following diagram gives the result of his investigations:—



## FRICTIONAL TEST FOR CAPACITY TO RESIST OXIDATION.

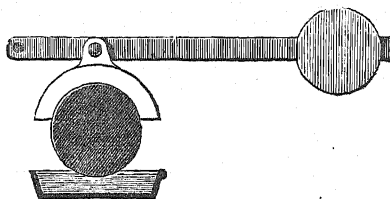
	Name of Oil.	Price	No. of Revolutions.	Degrees of Temperature.		No. of Degrees raised.	No. of Revolutions to 1 degree.	REMARKS.
				From	To			
1st day	No. 1 Ox.	5/6	13005	80°	200°	120°	108 $\frac{4}{13}$ <sup>6</sup>	First trial, new oil.
2nd day	Ditto.	5/6	11787	78°	200°	122°	96 $\frac{7}{12}$ <sup>2</sup>	No fresh oil was added to the 2nd trial.
1st day	Sperm Oil	9/0	16044	65°	200°	135°	118 $\frac{1}{11}$ <sup>1</sup>	First trial, new oil.
2nd day	Ditto.	9/0	13104	62°	200°	138°	94 $\frac{32}{13}$ <sup>2</sup>	No fresh oil was added for the 2nd trial.
1st day	Mineral Oil	3/6	11831	65°	200°	135°	87 $\frac{28}{13}$ <sup>3</sup>	First trial.
2nd day	Ditto.	..	0	0	0	0	0	Second trial,—after standing 24 hours the saddles were found to be so glued to the drum that the machine could not be started, though the belts were tightened, showing that the oil was of so gummy a nature as to be useless after once using.

This method of tabulation is, I think, a good one to use with this mode of testing.

*Longevity of Lubricants.*

Supposing an oil to possess all the qualities which we think a good lubricant should have,—that it has fluidity in reason, and that it does not combine with the atmosphere and become varnish,

that it does not become like water in summer, and like mutton suet in winter, and is in most respects satisfactory. We then want to know its powers of endurance, its capacity to resist wear and tear, in other words its longevity.



TEST FOR LONGEVITY.—(*Hatcher.*)—Fig. 6.

A good test for longevity or durability of oil when subject to either heavy or light frictional pressure is one suggested by Mr. W. H. Hatcher, a very careful investigator, and Chief of the Laboratory of Price's Patent Candle Company, who are extensive oil manufacturers. It consists in taking away the bottom step of the Stapfer tester and placing a small dish containing oil underneath the friction roller (see Fig. 6). This oil is carefully weighed before and after several hours' frictional wear and tear.

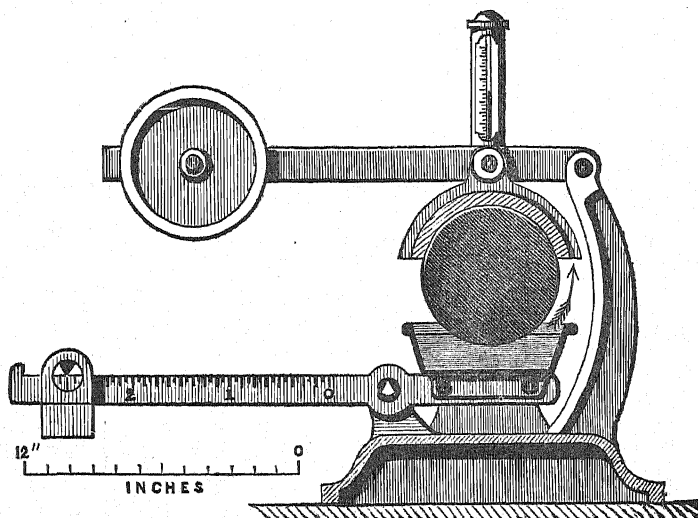


Fig. 7.

SOLID LUBRICANT TEST.—RAILWAY PATTERN, WITH SCALE BEAM.

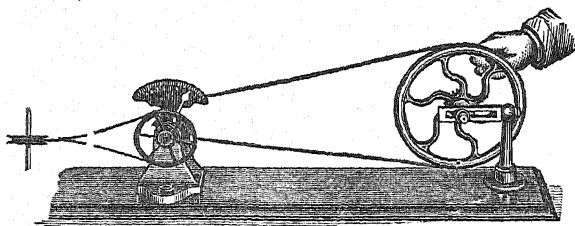
The drawing (Fig. 7) shows the application of this mode, which I have designed, for testing solid lubricants, such as lard and sulphur and other railway and steamship mixtures. It will be seen that the material is kept to its duty by the weighted lever, and its progress of diminution can be tested in its place by the scale beam arrangement.

The large Stapfer tester (Fig. 8) was designed a few months ago, for this purpose, for the Government railways of New South Wales, and it is also used by the Manchester Sheffield and Lincolnshire, and Lancashire and Yorkshire, and other railways. I have not been able to get any results of these tests in time for the present number, but hope to do so at some future time. The frictional roller is 6 inches in diameter, the pressure amounts to 1 cwt. on each step.

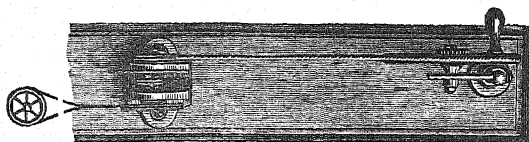
As it takes a considerable time to wear away half a pound of solid lubricant it may be advisable to measure by minutes instead of using the speed index. The speed should be at least 1500 revolutions per minute.

The Stapfer tester should be used in a room of equal temperature and should not be subject to draughts of cold air, as, it will be obvious, these will interfere with the indications of the thermometer.

*Testing by Measuring the Power Absorbed by Motion.*



DYNAMOMETER TEST.—(Crossley.)—Fig. 9.



ELEVATION.—Fig. 10.

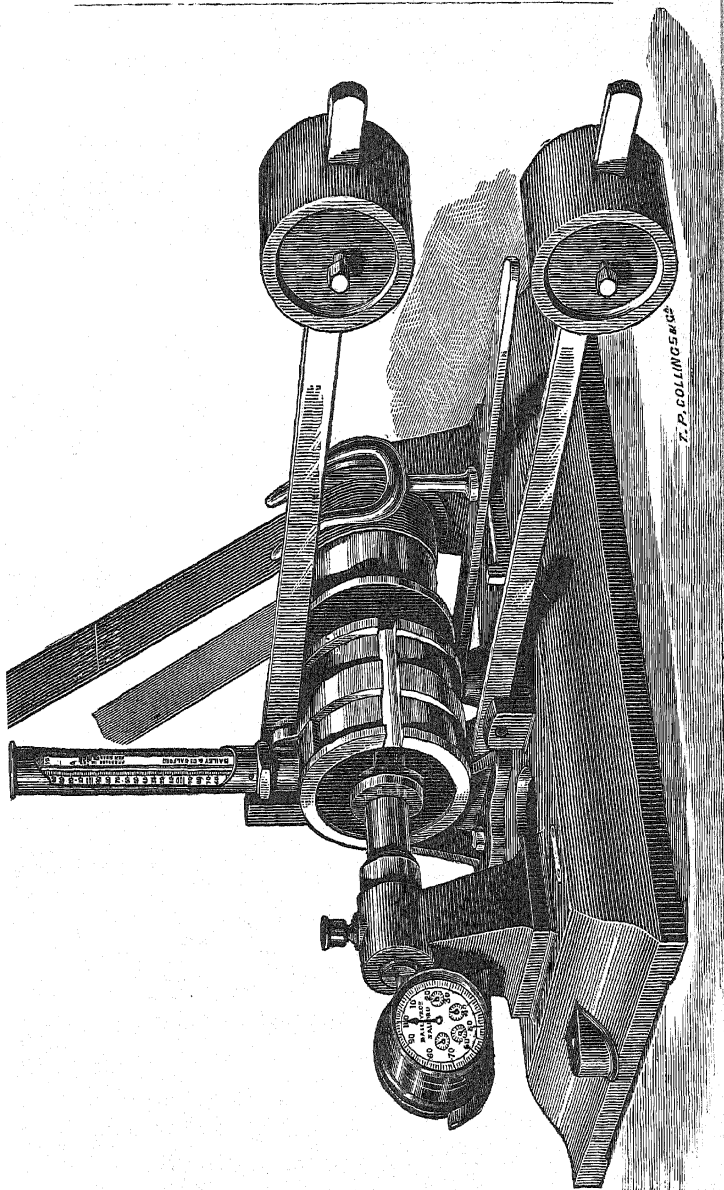
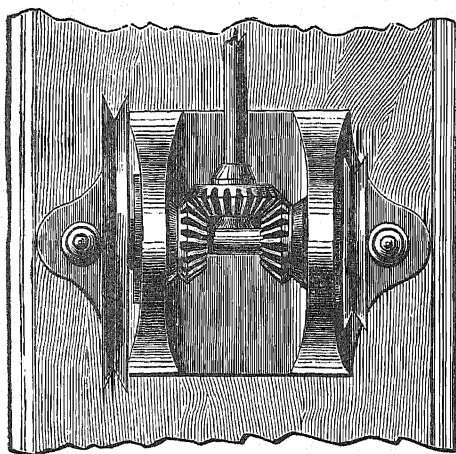


Fig. 8.



PLAN—ENLARGED VIEW OF DYNAMOMETER.—Fig. 11.

Some short time ago Mr. J. L. Crossley, of the well-known Halifax firm, designed a small dynamometer for indicating the amount of power absorbed when driving spindles lubricated with different sorts of oil. The mode is a slight improvement on the one I saw of his, which I am sure he would acknowledge. Mr. Crossley has informed me that he has obtained useful information by this mode of testing.

Mr. Henry Newall, of Manchester, informs me that he has caused oils to be tested by taking diagrams of a steam engine every hour, the sole work of the engine being the driving of several hundred spindles, lubricated each day with different sorts of oil, the amount of power absorbed at each hour giving valuable information. This method of testing is costly and requires the most elaborate care; the temperature of the room, the condition of the engine, regularity of speed, state of the barometer, exclusion of dust and draughts of air, all would require to be watched, but if well done there cannot be any doubt about its having many things to recommend it as being a proper way to test oil,

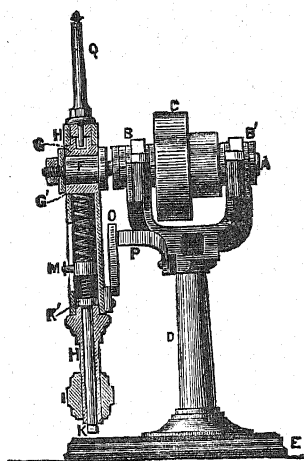
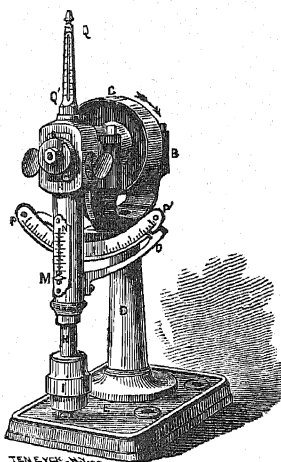
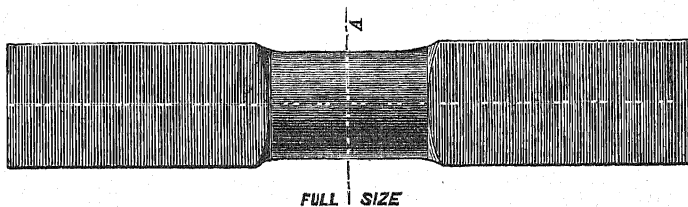
*Professor Thurston's Method of Testing.*

Fig. 12. PATENT FRICTION TEST.—(Thurston.) Fig. 13.

The testing machine to which I now direct your attention, is a very ingenious one. It is the invention of Professor R. H. Thurston, of the Technical College at Hoboken, New Jersey, United States, a gentleman whose name may be familiar to many; his experiments on the stripping of bolts and nuts were published in the *Engineer* a few weeks ago. I have his Torsional testing machine, and a member of this Society wishing to test metal may have the free use of one at my works with pleasure.\* I have had the benefit of a lengthy correspondence with this gentleman in connection with this and other kindred subjects, and have received much valuable information, which has been of



\* It may be as well to state that iron, or steel, or other material of construction to be tested should be of  $\frac{3}{8}$ -inch square, turned round in the middle. If several specimens are prepared it will save time; the cut shows the full size of the test piece.

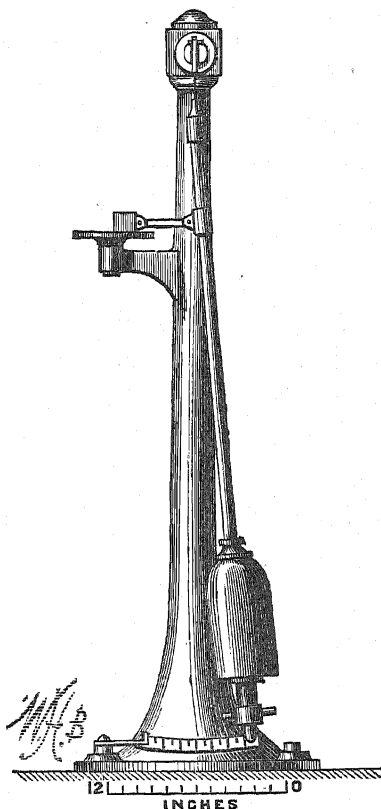
material assistance to me. The Thurston tester is very similar to that invented by Mr. Stapfer. You will see that it consists of a journal carrying a small shaft in two bearings. This journal is grasped by brass steps which are in connection with a pendulous weight. These brass steps are forced against the journal by means of a screw which compresses a coil spring. The amount of this pressure is indicated on a scale like that of a spring balance. A "bob" at the end of the pendulous arm gives the weight necessary to resist deflection. The angle of deflection is measured on an arc, or quadrant, in such units that the division of the figures may be read off; and give, not only the angle of deflection, but also the co-efficient of friction. A thermometer on the top brass gives the temperature in a manner similar to that of the Stapfer tester. This machine is used much in the same way as the tester I have previously described. It is used in the engineering shops of the United States' Navy, and I have had the results of experiments, which are too copious to give, but I will call attention to some which may be of value. The following table gives the results of experiments conducted under the personal direction of Professor Thurston,—the rubbing surfaces being driven at the rate of 750 feet per minute:—

CO-EFFICIENTS OF FRICTION AND ENDURANCE OF LUBRICANTS.—*Thurston.*

Name.	Pressure.	Endurance.	Rise of Temperature.	Co-efficient.	Name.	Pressure.	Endurance.	Rise of Temperature.	Co-efficient.
	Lbs.	Min.	F.			Lbs.	Min.	F.	
Sperm (Winter)	8	111	230	0.13	Cotton Seed	8	107	185	0.16
Oil .....	16	29	225	0.10	Oil .....	16	45	275	0.12
	48	9	195	0.08		48	12	310	0.07
Sperm (Summer)	8	165	170	0.13	Palm Oil ....	8	49	195	0.17
Oil .....	16	33	215	0.11		16	15	235	0.13
	48	7	265	0.10		48	9	295	0.07
	8	77	175	0.16	Castor Oil ..	8	45	160	0.19
Lard Oil .....	16	27	250	0.12		16	35	180	0.11
	48	11	260	0.07		48	11	375	0.07
	8	106	205	0.15	Fish (Cod) Oil	8	40	200	0.15
Neatsfoot Oil ....	16	31	275	0.10		16	14	175	0.12
	48	6	190	0.10		48	9	220	0.07
	8	83	170	0.13	Crude Mineral	8	129	105	0.10
Olive Oil .....	16	41	245	0.10	Oil .....	16	97	285	0.10
	48	14	240	0.06		48	5	270	0.10

This high speed was purposely chosen, otherwise the trials under moderate pressure might occupy many days. It will be observed that, in addition to giving the time of endurance in minutes, the pressure per square inch on the journal has been noted, as well as the rise of temperature and the co-efficient of friction. It will also be seen that the various lubricants were tested with eight pounds pressure, with sixteen pounds, and with forty-eight pounds pressure per square inch, so that the behaviour of each oil under heavy and light pressure could be criticised.

*Pendulum Friction Test.*



PATENT FLUIDITY AND OXIDATION TEST.—(Bailey.)—Fig. 14.



I have designed a pendulum test which I think may be found useful in testing oils which will not be subjected to heavy pressures, such as the conditions under which oils will be used for clocks and watches and light spindles. This consists of a pendulum (Fig. 14) to which is attached a link, which imparts a reciprocating motion to a small piece of brass. By simply placing one drop of oil on the surface of the brass and noticing how many times different oils will permit the pendulum to vibrate without stopping, useful information may be obtained about the value of a lubricant when not subjected to heavy wear and tear. The behaviour of an oil may be also noticed when subject to atmospheric influences, by taking note of the different vibrations, with one, two, or more days of an interval. It may thus indicate any process of deterioration and any incapacity to resist oxidation and tendency to become varnish. This mode of testing may be valuable to those who have not steam power to drive the Thurston or Stapfer Testers, and it will give, in a very definite manner, the test for oxidation after exposure, quicker probably than those instruments. I hope at a future date to lay before this society the result of experiments on this instrument. This instrument may be used for testing the friction of different metals on each other, and also throw some light on *V* slides *versus* flat surfaces of planing machines as suggested by one of the members of the society.

*Old Friction Test.*

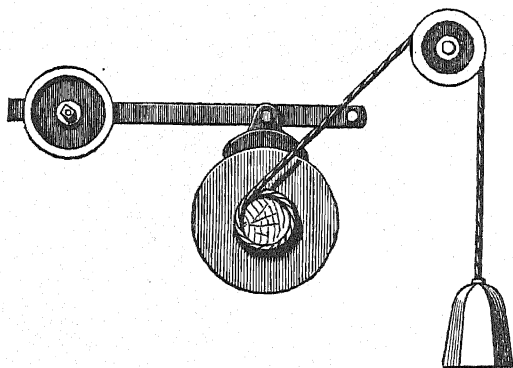


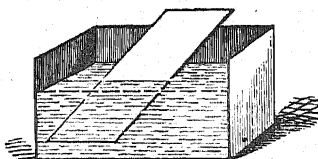
Fig. 15.

Fig. 15 represents a mode of testing oils which was used in Manchester some years ago. It consisted of a friction drum upon which oil is placed. A heavy weight, raised by means of a winch arrangement, was allowed to drop several feet. This imparted considerable velocity to the drum, the difference in the number of the revolutions of the drum indicating the value of the lubricant. This, however, was found uncertain in its indications, and its use has been discontinued.

*Testing for Salts and Acids, &c.*

It will be obvious that however good as a lubricant an oil is, and however valuable its properties may be when examined, if it possesses any corrosive quality which will be injurious to the metals upon which it is placed, it will soon become detrimental to the machinery, and also may cease to be valuable as a lubricant.

Mr. William Thomson, Analytical Chemist, of Manchester, read a paper on this subject at the British Association Meeting, held at Glasgow, and he there at great length, stated the results of elaborate experiments conducted by him to discover the influence of various oils of commerce upon bright strips of copper. He permitted the copper strips to remain entirely covered by oil. He also conducted similar tests with half of the strip below the surface of the oil, and the other half exposed to the atmosphere, in order to see what influence the oil had, when the surface line touching the metal would, of course, be acted on by the atmosphere. (Fig. 16.) After noticing the effect upon the brightness or dulness of the copper, he carefully tested the oils in order to detect the quantity of metal which had been dissolved.



TEST FOR BODIES IN OILS WHICH ACT UPON COPPER AND OTHER METALS.

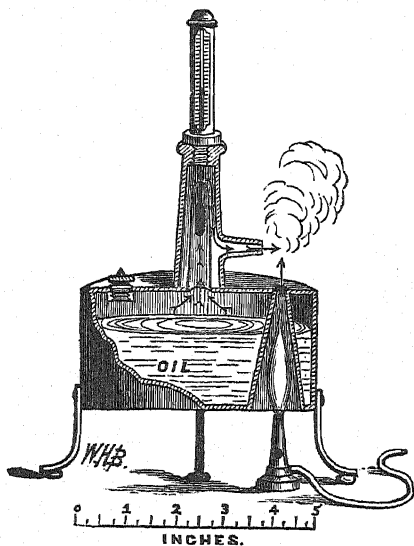
(*W. Thompson.*)—Fig. 16.

Mr. Thompson found the following oils dissolved the largest proportions of copper, leaving the surfaces of the copper slips

bright,—rape, linseed, sperm, raw cod liver, Newfoundland cod, and common seal oils; and that the following dissolved much smaller proportions of copper, also leaving the slips bright,—seal, whale, cod, shark, and East Indian fish oils; and that mineral oils seem to have no dissolving power on the copper, the only effect being a slight discolouration on the copper slip, of a greyish colour. Those who are much interested in this portion of the subject, will no doubt be able to obtain a copy of Mr. Thomson's paper, by applying to him, at the Manchester Royal Institution.

*Flash Point Test.*

There are some light mineral oils which are dangerous to use, because of the low temperature at which the vapours from them ignite. Some few years ago there was a great outcry against these oils, because several fires in cotton mills were said to have been caused by them.



"FLASH" POINT TESTER.—(Bailey.)—Fig. 17.

Oils may be tested for the existence of this condition by an instrument similar to Fig. 17, which is an improvement I have designed on one used, in the United States generally, for testing

illuminating oil. The engraving scarcely requires description. It will be seen that the oil is placed in a small copper vessel; care being taken to fill it only about three-quarters full, as oil expands much when heated. A spirit-lamp or Bunsen burner, placed underneath, causes vapour to issue at the little tube. As this vapour ascends, it passes the bulb of the thermometer, which records the temperature, and thus enables the operator to note the point of ignition. Oils are considered unsafe as lubricants if they ignite at a temperature lower than 212 degrees Fahrenheit.\*

*Swiss Watchmakers' Test for Fluidity and Capacity to resist Cold.*

It seems, according to the *Watchmaker and Jeweller*, a monthly trade journal, that the plan I have described, and what may be called the warm glass test, seems to be looked upon with favour for testing oil in Switzerland. The degree of heat used for testing the fluidity of oil is 200° Fahrenheit, and if this causes the oil to become a varnish two or three days after the test, the oil is considered unfit for use. Another test is one to which I have not alluded, and that is, capacity to resist low temperatures. Oils are tried for their capability to withstand low temperature in the following manner,—fifteen parts of Glauber's salts are put into a small glass vessel, a small bottle of oil to be tested is immersed into this; this done, a mixture of five parts of muriatic acid and five parts of cold water are placed over the salt. By means of a thermometer the temperature is controlled, and when it shows a very low temperature, the behaviour of the oil, subjected to this freezing mixture, may be observed and noted. Mr. Thomson, however, considers that this mixture is not so good, or so cheap as ice alone, or a mixture of ice and common salt.

*Blotting Paper Test.*

It seems it is considered that the blotting-paper test for fluidity is

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\* The instrument here illustrated has been suggested to some extent by Regnault's apparatus for testing the boiling point of thermometers, and it may be used for that purpose if water may be used instead of oil.—See "*Heat*," by Professor Balfour, p. 12, Clarendon Press Series.

It may also be used as a mountain height thermometer for indicating altitude above the level of the sea, by the varying boiling point of water due to the difference of the barometric pressure.

more reliable, according to the writer of the article, than the inclined plane experiment. In order to use this test, we must saturate the strip of blotting-paper with oil, and watch whether the drops fall off in pearls or have an inclination to spread out. The latter is a certain sign, the writer says, of a viscid oil. Although this may be considered viscid oil, and may not be valuable for watches, it may, however, be a good oil for heavier machinery.

*The Value of the Experience of the Members of this Society on Friction and Lubrication.*

I have endeavoured to say something about friction and lubrication, but I feel there is a great deal left untold. It is an important subject, and one which must have had the personal attention, at one time or other, of every gentleman in this room. I know of no association in existence, anywhere, whose members are so identified to the same extent practically with the working of steam engines and machinery as the members of this association; for it may be said that our members have control over more steam power than any equal number of men in the world. Can we not make their experience (often dearly bought) useful? I venture to hope that I have been able to impart such interest to the subject as will induce some of them to give us the benefit of their knowledge and observations on friction and lubricants, as well as on those kindred subjects, the shapes of, and the materials used, for bearings, as well as on the different methods of lubrication, or other means of reducing friction. Those who have not time to prepare long papers, might, with advantage to the society, give short papers in preference to none at all.

*Guesswork versus Science.*

In every department of workshop economy there is plenty of employment, and ample reward for those who will devote their abilities to the scientific use of mechanical motion, which is only the common-sense use of machinery. Clumsy, slovenly guesswork,\*

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\* The late Richard Roberts, of Manchester, the inventor of the Self-Acting Mule, once asked a man the diameter of a hole, who replied "an inch and a bit." Roberts was so enraged that he at once told him to go and "put his coat on."

the cause of much laborious mental and physical drudgery, are slowly being cast into outer darkness; exact method being given us, by men of science, who wait in attendance on engineers, ever ready to hold the torch and act as guides to those who are willing to colonise new worlds.

Knowledge of heat has been elevated to a science by Dr. Joule, who has taken us out of the region of unsystematic conjecture to that of fact,—from wandering in the wilderness to the realms and rule of law.

This science teaches us that the relations, between heat and mechanical motion, are regulated by well-defined, accurate, and rigid principles. Those who would command nature's forces must first learn her laws;\* the first rudiments of which say, that when we produce frictional heat in our machinery, we become law-breaking prodigals, who have incurred fines and penalties, which are generally paid when a cheque is given to settle the coal bill.

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## ON AREOMETER.

By P. CASAMAJOR.

Read before the American Chemical Society, April 5th, 1877; and sent, by favour of the Author, for insertion in this Magazine.

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### PART I.

The last paper which I had the honour of reading before this society related to the corrections of the errors due to changes of temperature in volumetric analysis, and although the results which I gave found their application in an important branch of chemical science, I am not sure that my paper had otherwise a very close connection with chemistry. The favourable reception of this paper by many members, who have expressed to me great interest in its

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\* Lord Bacon said knowledge and human power are synonymous, since the ignorance of the cause frustrates the effect.—*Nov. Org.*

subject, induces me to offer you this evening a paper of a similar character, on areometers. Such is the constant use made by chemists of these useful and convenient instruments, that I feel I owe no apology for presenting the subject. In the first place, I propose to examine the nature of the scales of the areometers most generally used, and, in the second place, to apply the data obtained by this examination, and those given in the last paper which I read before this society, to the correction of the errors resulting from variations of temperature.

PART FIRST.—SCALES OF AREOMETERS.

A great portion of what I have to say on the scales of areometers, I have already published on several occasions;\* and although it is with regret that I have to present you with matter that I have published elsewhere, I have found no way of avoiding it, as otherwise the new matter I have to present would be incomprehensible.

Areometers are formed of two portions, the stem, which bears the graduation, and the bulb, whose diameter is considerably larger, and whose object is to avoid excessive length of the instrument. I must, however, for the purpose of studying the graduation of areometers, discard the bulb, and suppose that we have a geometrical cylinder of indefinite length.

If this areometer A B is to be used for liquids heavier than water, we will suppose that its weight is such that, when immersed in pure distilled water, at the normal temperature, it will sink to a point c, near the top of the cylinder. This is an important reference point in all areometers, as it corresponds to the unity of specific gravities of liquids.

As a floating body is in the state of equilibrium in a liquid, when the weight of the liquid displaced is equal to the weight of the

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\* Testing Sugar Solutions, *American Chemist*, Oct. and Nov. 1873.

On the Formula of Francœur, &c., (*ibid.*,) Feb., 1874.

Expansion of Sugar Solutions by Heat, (*ibid.*,) June, 1874.

Nouveau Procédé pour la Détermination du coefficient de pureté des dissolutions sucrées.—*Moniteur Scientifique*, March, 1877.

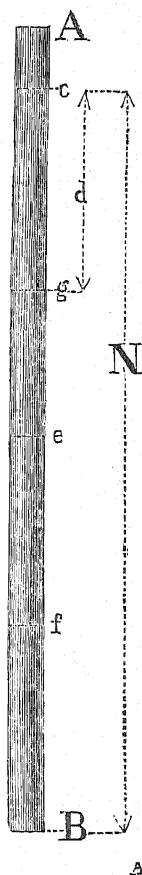
floating body, if we place our cylindrical areometer, which sinks to *c* in pure water, in a liquid whose specific gravity is double that of water, it will sink to a point *e*, placed in such manner that  $B = \frac{Bc}{2}$

This happens because, in a geometrical cylinder, the distances *Bc*, *Be* are proportional to the volume between these points, and because the new liquid being twice as heavy as water, it takes half the volume to float the areometer. In the same manner, if it was possible to obtain a liquid four times heavier than water, the aerometer would sink to a point *f*, so placed that  $Bf = \frac{Bc}{4}$

If now we call the specific gravity of water 100, and if we place numbers opposite to *c*, *e*, *f*, which express the corresponding specific gravities, we shall have 100 opposite to *c*, 200 opposite to *e*, and 400 opposite to *f*. If we make intermediate divisions, each expressing an increase of specific gravity equal to  $\frac{1}{10}$  part of the specific gravity of water, there will be 100 such divisions between *c* and *e*, and 200 between *e* and *f*. The space *ef* is, however, one-half of *ce*, so that the mean length of a division between *c* and *e* must be four times greater than that of a division between *e* and *f*. By making the same calculation for any portion of the stem, we may see that the decrease of the length of the divisions is gradual from *c* to *f*. A scale of this kind is called *uneven*.

We may, on the other hand, starting from the point *c*, divide the space *cB* into a certain number of equal parts. A scale of this kind is called *even*, and I may remind you that the greatest portion of the areometers used in the arts have even scales.

We are naturally led to inquire whether any relation exists between even scales and scales expressing specific gravities. I have seen it clearly stated in books that no such relation exists, and that the





correspondencies of these divisions are found by means of tables, which, it must be inferred, were obtained experimentally, or by means of empirical formulas.

I believe that Francœur was the first mathematician who studied the relations between these two classes of scales, and he has left us two formulas, one for Beaumé's areometer for liquids heavier than water :

$$P = \frac{152}{152-d}$$

and the other for Beaumé's instrument for liquids lighter than water

$$P = \frac{146}{136+d}$$

In these formulas, P represents the specific gravity, while d is the corresponding degree of an even scale.

We shall have occasion to return to these formulas, after we have studied the general relation which exists between the divisions of even scales and their corresponding specific gravities.

To discover this relation, let us suppose that we have placed our cylindrical areometer in a liquid of specific gravity P, and that it has sunk to a point g of the stem. As the weight of liquid which buoys up an areometer must be equal to the weight of the areometer itself, the volumes of liquid displaced are inversely as their specific gravities. Now if we divide the space c B into a certain number, N, of equal parts, and if we find a number d of these divisions between c and g, the distance c B, which is the portion submerged in pure water, will be expressed by N divisions or degrees, while the space g B, the portion submerged in a liquid of specific gravity P, will be N—d, and we shall have the equation :

$$\frac{P}{1} = \frac{N}{N-d}$$

from which, knowing d, we may calculate the value :

$$N = \frac{Pd}{P-1} \quad (1)$$

From this equation we may find the whole number of degrees of even scale from c downwards. This number N is obtained by multiplying the specific gravity by the corresponding number of degrees,

and dividing this product by the difference between the same specific gravity and unity.

If we know the value of N for any scale, we may, inversely, calculate the value of d when P is known, or the value of P when d is known, by these formulas :

$$P = \frac{N}{N-d} \quad (2)$$

$$d = N - \frac{N}{P} \quad (3)$$

In Beaumé's original areometer for liquids heavier than water 15° corresponded to sp. gr. 1.109. Formula (1) will give us, in this case,

$$N = \frac{1.109 \times 15}{0.109} = \frac{16635}{109} = 152.6$$

If we neglect 0.6, formula (2) will give us

$$P = \frac{152}{152-d}$$

as given by Francoeur.

Although this formula was correct for the original *pèse sel* of Beaumé, it does not answer for the instrument now sold as Beaumé's areometer, in which 66° correspond to the point to which the instrument sinks in sulphuric acid,  $H^2SO^4$ . Taking 1.845 for the specific gravity of  $H^2SO^4$ , we have by formula (1)

$$N = \frac{1.845 \times 66}{0.845} = \frac{121770}{845} = 144.02, \text{ or } 144$$

As Beaumé's areometer is extensively used in the arts, many chemical, technological and pharmaceutical books give tables for the conversion of its indications into corresponding specific gravities. In these tables, N is sometimes 152, sometimes 144, and at other times 145, 145.4, &c. It is a matter of some importance to determine the value of N in any table. Fortunately this may be done at a glance by observing the degree Beaumé which is equal to the fractional part of the number expressing the corresponding specific gravity. The quantity N is that specific gravity multiplied by a 100. If we find in a table that 52° B=1.52 sp. gr., then  $N=152$ ; for if in the equation

$$P = \frac{152}{152 - d}$$

we make  $d$  equal to 52,  $P$  will be 1.52, and if in the equation

$$P = \frac{144}{144 - d}$$

we make  $d=44$ ,  $P$  will be 1.44.

It is very easy to do for other areometers what we have done for Beaumé's *pèse sel*. Let us take, in the next place, Beaumé's areometer for liquids lighter than water, which is extensively used in this country for petroleum products of all kinds. Beaumé obtained the scale of this instrument by calling 0 the point of the stem to which the areometer sinks in a solution of 10 parts of salt in 90 parts of water, and 10° the point in which it sinks in water. The instrument is graduated from 10° upwards.

To find the value of  $N$ , let us temporarily call 0 the point to which it sinks in pure water, and 10° the point to which it sinks in a solution containing 10 p. c. of salt, whose specific gravity is 1.07353. By formula (1) we have

$$N = \frac{1.07353 \times 10}{0.07353} = \frac{1073530}{7353} = 145.99$$

or 146. As in this instrument, the total number of degrees below 0 is 136; when the degree indicated is  $d$ , the volume that sinks in the liquid is  $136 + d$ , and we have

$$\frac{146}{136 + d} = \frac{P}{1}$$

$$\text{whence } P = \frac{146}{136 + d}$$

$$\text{and } d = \frac{146}{P} - 136$$

This formula was also given by Francœur.

Next to Beaumé's *pèse esprit*, we are naturally led to speak of Cartier's areometer, much used in the south of France for brandies. In this instrument 10° correspond to sp. gr. 1, as in Beaumé's, but 40° correspond to 44° Beaumé; therefore the space occupied by 11° Beaumé corresponds to 10° Cartier, and the value of  $N$  is

$$\frac{146 \times 10}{11} = 132.72$$

nearly 133, and the formula giving the relations of the specific gravities to degrees Cartier become

$$P = \frac{133}{123 + d}$$

$$d = \frac{133}{P} - 123$$

In the next place, I propose to apply our formulas to an areometer of even scale, of which we heard a great deal at our last meeting. I mean the lactometer of the New York Board of Health. In this instrument 0 represents the point of the stem to which it sinks in pure water, and 100° represents the point to which it sinks in a liquid having the specific gravity 1.029.

Formula (1) becomes in this case,

$$N = \frac{1.029 \times 100}{0.029} = \frac{102900}{29} = 3548.2$$

in which we may neglect 0.2.

Formulas (2) and (3) become

$$P = \frac{3548}{3548 - d}$$

$$d = 3548 - \frac{3548}{P}$$

In the next place I propose to apply these formulas to the areometer of Balling, which shows the quantity of sugar, by weight, in 100 parts of a solution. Although this areometer, as found at the dealers, has always an even scale, the percentages of sugar cannot be expressed by such a scale. We may, however, if we only take a limited portion of a scale, in which every degree represents an additional 1 per cent. of sugar, have an even scale, in which the errors are not appreciable, by taking for the average length of every degree the length of every degree equally distant from the extremes. The Balling areometer, which I use in my process for testing sugar solutions, ranges from 5° to 15°, and I have adopted an even scale of which 1.805° is equal to 1° Beaumé, this being the relation at 10° Balling. For this instrument, to which we shall have occasion to refer in the second part of this paper, the value of N is  $144 \times 1.805 = 259.92$ , or 260. For the whole Balling scale I have found that

the formula  $D = 1.8d + 0.002d^2$ , in which  $D$  is the degree Balling, and  $d$  the degree Beaumé, gives values of  $D$  which are correct within less than  $\frac{1}{2}^\circ$  Balling up to  $75^\circ$  Balling, thus :—

10° Beaumé	give	18.2,	instead of	18.05
20°	„	36.8,	„	36.44
30°	„	55.9,	„	55.47
40°	„	75.2,	„	75.27

Having now examined to specific gravity scale Beaumé's two areometers, the *pèse esprit* of Cartier, the lactometer of the Board of Health, and the areometer which indicates the percentage of sugar in a solution, I believe I have reviewed all the instruments of this kind that are used to any extent, except alcoholometers and Twaddle's hydrometer. Alcohometry is too extensive a theme to be brought incidentally into our subject. Besides, little or nothing remains to be said about it after the labours of Tralles and Gay Lussac. As to Twaddle's scale, it is a disguised specific gravity scale, in which the specific gravity of water, instead of being 1, is 200. This number, however, is subtracted from the indication. Thus specific gravity 1.12 is 240, but is written 40; specific gravity 1.8 is 360, but is written 160; so that to find the specific gravity corresponding to the indication of Twaddle's scale we must add 200, and divide the sum by 200.

There is a quality in areometers called *sensitiveness*, by virtue of which a small difference of density in liquids corresponds to a decided difference in the scale of the instrument. If we suppose that our areometer is a geometrical cylinder, the distance between two indications of the scale corresponding to two specific gravities is proportional to the whole length of the instrument, from the point corresponding to pure water to its lower extremity. From this we may deduct a convenient method of expressing numerically the sensitiveness of an areometer, by supposing it to be a geometrical cylinder, and stating its length in inches. This quantity is easily calculated, in the case of an even scale, by finding a certain number of inches corresponding to a certain number of degrees. If we take the coarse Beaumé areometer, having a thick stem, which is commonly used in the arts, in which  $12\frac{1}{2}^\circ$  are comprised in the length

of an inch, we will find the whole length to be  $\frac{144}{12\frac{1}{2}} = 11\frac{1}{2}$  inches.

In the lactometer of the Board of Health,  $100^\circ$  occupy  $3\frac{1}{2}$ , or 3.625 inches; then the whole number of degrees, 3548, would occupy

$$\frac{3.625 \times 3548}{100} = 128.61 \text{ inches} = 10 \text{ feet } 8.61 \text{ inches.}$$

In the areometer which I use for testing sugar solutions,  $6^\circ$  Balling, divided into tenths, occupy  $2\frac{1}{2}$  inches; so the whole number of degrees = 260 must occupy

$$2.5 \times \frac{260}{6} = 111\frac{2}{3} \text{ inches} = 9 \text{ feet } 3.6 \text{ inches.}$$

To find the total length of a specific gravity areometer we may calculate the number of degrees of an even scale which correspond to two points placed a known distance apart, and thence find the length corresponding to the whole number of degrees. Geisler's areometer for Ventzke's sugar test, studied in this way, gives a whole length of 200 inches, or  $16\frac{2}{3}$  feet.

We have seen that if we know the specific gravity of a liquid we may deduct the corresponding degree of any even scale, and *vice versa*. These relations afford us a sure method of verifying the correctness of the graduation of any areometer of even scale, by determining with the balance the specific gravity of a liquid, and comparing the corresponding division of even scale with the indication of the areometer under observation.

We may also convert the indications of any aerometer of even scale into corresponding degrees of any other even scale. This is done by dividing the number of degrees to be converted by the total number of divisions of its kind, and multiplying this quotient by the total number of divisions of the kind we require. If we wish to know, for instance, what degree Beaumé is equivalent to  $100^\circ$  of the lactometer of the Board of Health, we will find that

$$\frac{100 \times 144}{3548} = 4.058 \text{ Beaumé.}$$

Areometers of even scale have this precious property, that—provided the divisions are equal to one another, and the calibre of the

stem is even—we may obtain accurate results by their use, even if the divisions have not the proper length, and if the point corresponding to pure water has been misplaced. By determining the specific gravity corresponding to two points of an even scale under observation, we may correct any indication of such a scale. In *American Chemist*, for October, 1873 (vol. iv., p. 130), and in *Sugar Cane*, for January, 1874 (vol. vi., p. 28), these calculations may be found at full length.\*

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\* On reading over the corrections for areometers of even scale, in *Sugar Cane*, for January, 1874, I find that the subject may be presented in a more satisfactory manner, and more in harmony with the results of this paper, as follows:—

To ascertain the correctness of an areometer of even scale, we find by compasses and callipers that the divisions are equal to each other, and that the calibre is even, otherwise the instrument is not fit for accurate work. If these two points are satisfactory we make two solutions, A and B, of different densities, B being the more dense. A must correspond to one end of the scale, and B to the other, but both must be within the scale. The temperature of the solutions should not be very different from that of the room, so as to remain constant for some time. The areometer to be examined should be placed successively in each solution. Let us call the two indications  $a$  and  $b$ . In the next place, the specific gravity should be taken by the balance, which we will call  $P$  for A, and  $P'$  for B. The degrees corresponding to  $P$  and  $P'$  are calculated in the case of the total number of degrees  $N$ , and we obtain :

$$c = N - \frac{N}{P}$$

$$e = N - \frac{N}{P'}$$

If  $a = c$  and  $b = e$ , the areometer is properly graduated.

If  $a$  is not equal to  $c$ , and  $b$  is not equal to  $e$ , but still  $b - a = e - c$ , the divisions of the scale are correct, but have been misplaced, the misplacement  $m = c - a = e - b$ ,  $m$  being positive or negative, and it is to be either added to or subtracted from the degree of the areometer to effect the correction.

Again,  $a$  may be greater or smaller than  $c$ , and  $b$  greater or smaller than  $e$ , and at the same time  $b - a$  is not equal to  $e - c$ . In this case the degrees themselves have not the proper length, and we are led to ask what is  $N'$ , the total number of degrees of the areometer under examination? If we call  $n'$  the number of degrees between  $c$  and  $e$ , and  $n$  the number between  $a$  and  $b$ , we have the relation

In conclusion of this first part, I will examine a point which was introduced at our last meeting. We were told that if we refer the divisions of an areometer of even scale, and the corresponding specific gravities—1 to rectangular co-ordinates, the law of their relations is expressed by a right line. To those who remember their analytical geometry, it is easy to show that this is not the case, for if we take the equation

$$\frac{Pd}{P-1} = N,$$

which we have had to use repeatedly, and in which are comprised the quantities  $d$  and  $P-1$ , and if we multiply both terms by  $P-1$ , and divide them by  $P$ , we shall have

$$d = (P-1) \frac{N}{P}$$

Now the equation of the right line is of the form  $d = m(P-1)$ , in which  $m$  is a constant, while  $\frac{N}{P}$  cannot be a constant as  $P$  is variable, therefore

$$d = (P-1) \frac{N}{P}$$

cannot give a right line.

$$\frac{N'}{N} = \frac{n'}{n}$$

$$\text{whence } N' = \frac{n'N}{n}$$

When the degrees of the scale have not the proper length, two cases may occur—1° The 0° (pure water, normal temperature) is in the right place. 2° The 0° has been misplaced. If

$$\frac{a}{c} = \frac{b}{e} = \frac{N'}{N}$$

the zero is in its place; and if we call  $d'$  any degree of the areometer under examination, the correct degree,

$$d = \frac{d' \times N}{N'}$$

If the 0 of the scale has been misplaced, the relation

$$\frac{a}{c} = \frac{b}{e} = \frac{N'}{N}$$

does not exist. To discover the amount of displacement, we must take either of the specific gravities  $P$  or  $P'$ , and determine the true degree corresponding to either  $a$  or  $b$ , on the base of  $N'$  being the total number of degrees. If we take  $a$  and sp. gr.  $P$ , the true degree

$$x = N' - \frac{N'}{P}$$

The quantity  $x - a$  shows the displacement  $m$ , which is positive if  $x > a$ , or negative if  $a > x$ , and the true degree

$$d = \frac{N}{N'} (d' \pm m)$$



By actually referring  $d$  and  $P-1$  to perpendicular co-ordinates, we find that the law is expressed by a curve, which does not differ materially from an arc of a circle, which curve turns its concavity towards the abscisses. The greatest deviation from a right line takes place about midway between the two extremes. This may be illustrated by taking Beaumé's areometer from  $0$  to  $50^\circ$ , in which  $0^\circ$  corresponds to  $P-1=0$ , and  $50^\circ$  to  $P-1=0.532$ . If the law was a right line, we would have the numbers of the second column, while the actual numbers are those in the third column.

Degrees Beaumé.	$m = \frac{P-1}{a} = \frac{0.532}{50}$ $m = 0.01064$	$P-1 = d \frac{N}{P}$	Difference.
$10^\circ$	0.1064 ( $14^\circ$ )	0.0746	0.0318
$20^\circ$	0.2428 ( $25^\circ$ )	0.1613	0.0515
$25^\circ$	0.2666 ( $30^\circ$ )	0.2101	0.0565
$30^\circ$	0.3192 ( $35^\circ$ )	0.2632	0.0560
$40^\circ$	0.4256 ( $43^\circ$ )	0.3846	0.0410

After the values of  $P-1$  in the second column, I have placed between brackets the nearest number of degrees to which they correspond.

(To be Continued.)

## LOCAL GOVERNMENT BOARD FOR IRELAND.

The following is extracted from a circular recently issued by the Local Government Board for Ireland, and addressed to each Sanitary Authority within that kingdom :—

“LOCAL GOVERNMENT BOARD, DUBLIN,

“22ND DECEMBER, 1877.

“FILTH REMOVAL.

“Sir,

“Adverting to previous circulars of the 5th August, 1875, of the 20th March, 1877, and 21st April, 1877, respectively, the Local Government Board for Ireland now propose to place before the

Sanitary Authorities in Ireland some further facts in relation to the subject of *Filth Removal* in towns situate in Great Britain.

“In the year 1873, the Pail System, for some time previously in operation at Rochdale and Manchester, attracted attention at Birmingham. Since its introduction at that date the number of pails has increased to no less than 20,000 in the year 1877, and is still increasing at the rate of 200 per week. This form, therefore, of Filth Removal appears to be likely to become the general system of Birmingham, after the example of Manchester, where, having been commenced in 1869, it is now more nearly advanced to general adoption.

“One important feature of the pail system, as practised at Rochdale and Manchester, is the periodical collection not only of the faecal deposits from the entire area of its operation, but also of all dry refuse from the ash-tubs associated with the pails, which, in bulk, forms the larger portion of the refuse of all towns.

“The modes of disposing of the Dry Refuse at Rochdale and Manchester have been previously described; but at Birmingham a new kind of machinery is in operation, patented by Mr. Fryer, the inventor, for the wholesale destruction by fire of otherwise useless debris,—deriving from the incinerated mass a valuable description of charcoal, and at the same time applying heated gases to the evaporation of moisture from the faecal deposits, without occasioning the loss of the ammonia which so greatly enhances the value of the manure.

“The resulting product, although obtained by a different process, is nearly identical with that manufactured by Liernur's process, and called Poudrette, which has been shown to be a manure dry and portable and of a high chemical value.

“Mr. Fryer's method of obtaining a similar manure, assuming it to be of equal chemical value, appears to deserve attention from the Governing Bodies of Towns which have not yet entered upon the introduction of any general system of domestic scavenging; because, in the first place, its action is comprehensive, providing as it does for the removal and utilization of every kind of town refuse; and secondly, because the only aid it demands in the collection of its

materials is the construction and scavenging of pails and ash-tubs, as economical a mode of collection as any other, and not involving, under any circumstances, a pollution of streams or of well-water, or any saturation of the soil with matters injurious to health. It may require, however, some time yet to determine whether this experiment, which is only yet on its trial, is destined to succeed.

\* \* \* \* \*

“ By Order of the Board,

“ (Signed.) B. BANKS,

“ Secretary.

“ *To the Executive Sanitary Officer*

“ *of each Sanitary Authority.*”

The following is extracted from a report presented to the Local Government Board of Ireland by their Special Commissioner, and printed for Her Majesty's Stationery Office :—

“ At Manchester the Health Committee of the Corporation have lately adopted Mr. Alfred Fryer's new and patented method of dealing with the refuse of towns, the machinery being manufactured by Messrs. Manlove, Alliot, & Co., Nottingham.

“ At Birmingham the same method has been adopted experimentally, and at the time of my visit the machinery had just got into operation at one of the refuse depôts, the Corporation having I believe granted £4000 towards the expenses of erection of the necessary machinery. This method claims to be simple and inexpensive, and deals with *foecal matters*, cinders, and ashes from dwelling-houses, animal matter from abattoirs, vegetable refuse from markets, and the miscellaneous accumulations from the surface of the streets. Street sweepings and all vegetable matter from markets and houses are passed through a carbonizing kiln kept in operation by a portion of the refuse cinders, and becomes transformed into a fine black powder, which is a valuable deodorant. The contents of old ashpits, consisting of cinders, ashes, animal, vegetable, and mineral refuse, bricks and bottles, a small quantity of manure, all saturated with water, are shot into the ‘Destructor,’ which is a furnace so arranged that when once in operation, the heat generated by com-

bustion is employed to aid in burning further material, and also to drive off the water from that next to be incinerated; all odour is removed, and a residue of clinker and ash remains which when ground up with hydrated lime makes excellent mortar. The waste heat from the Destructor is led through the 'Concretor,' and serves for concentrating urine. The 'Concretor' is a revolving cylinder of boiler plate, eight feet long and four feet six inches in diameter, and fitted inside with scroll-like plates of thin metal. The pails when they arrive at the yard are emptied over a coarse grating which will retain the tinned cans and other large solids, which may have found their way into the pails, the remainder falls into a tank. Thence the liquid passes into the 'Concretor,' and as it revolves the scroll-like surfaces become wetted. The evaporation is effected by passing heated gases through the cylinder. As these come into contact with the wetted surfaces of the metal scrolls, rapid surface evaporation takes place, the temperature of the liquid undergoing concentration remaining low, so low that when discharged from the cylinder at about the consistency of treacle it is rarely, if ever, at so high a temperature as 130° Fahr. The hot gases used for effecting evaporation in the 'Concretor' result from the combustion of refuse material in the 'Destructor.'

"By this means nearly all the water is removed, and the already existing ammonia is fixed by the sulphurous acid in the hot gases from the 'Destructor.' The fluid and semi-solid contents of the pails being thus deprived of nearly the whole of their water, may either be desiccated into 'poudrette,' or be mixed up with a portion of charcoal, in order to make a friable, odourless manure. These manures, it is stated, 'Being extremely rich and concentrated, are of high intrinsic value, more nearly resembling guano than any manure in the market.'

"This process of manufacture of manure would appear to be somewhat similar to that of Captain Liernur; the difference being, that in the latter process sulphuric acid is mixed with the material before it enters the evaporating chamber, for the purpose of fixing the ammonia, while in the former case the sulphurous acid in the hot gases fixes the ammonia during desiccation.

“This system of manufacture of part of the refuse of towns into manure, and destruction of what is valueless, would necessarily imply the adoption of a pail system, with the necessary means for a periodical collection and removal of all excreta and dry refuse by the scavenging carts.

“Pamphlets descriptive of Mr. Alfred Fryer's patents may be obtained from the manufacturers, Messrs. Manlove & Alliot, Nottingham.

“The commercial value of the manure has not yet, I believe, been established. The chemical value, I should think, would be about equal to that of the ‘poudrette’ produced by the Lierner process, which, according to an analysis made by Dr. E. W. Davy, Professor of Agriculture, Royal College of Science, Dublin, was about £9 per ton.

“This analysis was made from a sample manufactured in my presence at Dordrecht, which was then and there given into my possession and brought by me to Dublin. A larger sample was afterwards obtained and an experiment was made with it this season, and with other manures, to ascertain as far as possible their relative values as shown in the actual raising of crops. The roots grown in the soil manured by this poudrette showed a remarkable superiority in growth and size over those which grew in the adjoining soil treated by other manures. This experiment was made on the workhouse farm of the North Dublin Union, and it is due to Captain Liernur to state that his *poudrette* assisted in obtaining for the Guardians the Silver Medal given as First Prize for Workhouse Farm Produce at the Royal Society's Show in December, 1877.

“If equally successful in the production of a valuable manure, Mr. Fryer's system of reduction in connection with the pail system has a manifest advantage in the destruction or utilization of all that varied mass of the refuse of towns which is not applicable, otherwise than as fuel, to the manufacture of manure.

“W. A. POWER,

“December, 1877.”

## COMMERCIAL &amp; OTHER STATISTICS OF THE UNITED KINGDOM.

*From Francis Reid & Co.'s Annual Circular, January, 1878.*

Year.	ESTIMATED POPULA- TION. 31st DEC.	SUGAR, Raw & Refined.		MOLASSES		TEA.		COFFEE.		COCOA.	
		Tons.	Lbs. per Head	Tons.	Lbs. per Head.	Lbs.	Per Head.	Lbs.	Per Head.	Lbs.	Per Head.
1851	27,529,000	328,581	26.74	45,915	3.73	53,949,059	1.96	32,504,545	1.18	2,978,344	0.11
1852	27,570,000	358,643	29.14	38,662	3.14	54,713,034	1.98	34,978,432	1.27	3,328,527	0.12
1853	27,663,000	374,379	30.32	39,997	3.24	58,834,087	2.13	36,983,122	1.34	3,997,198	0.14
1854	27,788,000	416,620	33.58	42,336	3.41	61,953,041	2.23	37,350,924	1.34	4,452,529	0.16
1855	27,899,000	384,267	30.86	46,126	3.45	63,429,236	2.27	35,764,564	1.23	4,383,023	0.16
1856	28,154,000	374,978	29.69	47,111	3.75	63,272,212	2.25	34,995,944	1.24	3,634,135	0.13
1857	28,359,000	382,294	30.20	30,556	2.41	69,130,482	2.44	34,367,484	1.21	2,656,233	0.09
1858	28,566,000	450,203	35.80	43,829	3.44	73,217,484	2.57	35,338,111	1.24	3,071,115	0.11
1859	28,774,000	457,449	35.61	34,890	2.72	70,362,008	2.55	34,492,947	1.20	3,480,987	0.12
1860	28,944,000	448,070	34.61	27,998	2.58	76,859,428	2.66	35,674,381	1.23	3,481,484	0.12
1861	29,106,000	473,040	36.06	54,500	4.18	77,949,465	2.67	35,375,675	1.21	3,575,384	0.12
1862	29,400,000	485,856	37.24	55,840	4.22	78,817,060	2.68	34,664,155	1.18	3,926,500	0.13
1863	29,600,000	495,050	37.46	37,452	2.83	85,206,776	2.88	32,986,116	1.11	4,106,468	0.14
1864	29,820,000	499,604	37.53	25,341	1.90	83,637,099	2.98	31,591,122	1.06	4,171,082	0.14
1865	30,000,000	545,781	40.75	28,692	2.14	97,921,944	3.26	30,748,349	1.02	4,286,635	0.14
1866	30,050,000	559,166	41.68	32,235	2.41	102,325,067	3.41	30,944,363	1.03	4,606,997	0.15
1867	30,200,000	593,358	44.01	20,186	1.50	111,057,705	3.68	31,567,760	1.05	4,585,517	0.15
1868	30,450,000	561,135	41.03	37,379	2.75	106,918,118	3.51	30,608,464	1.01	5,730,223	0.19
1869	30,750,000	583,369	42.17	37,088	2.70	111,889,118	3.61	29,109,113	0.94	6,564,216	0.21
1870	31,100,000	666,368	48.00	35,790	2.50	117,662,575	3.73	30,629,710	0.99	6,943,109	0.21
1871	31,500,000	702,201	49.93	34,181	2.43	123,529,642	3.92	31,010,645	0.98	7,333,988	0.23
1872	31,750,000	715,400	50.47	31,045	2.19	127,792,412	4.02	31,661,311	1.00	7,853,165	0.25
1873	32,000,000	786,033	55.02	28,220	1.97	132,022,155	4.12	32,330,928	1.01	8,311,023	0.26
1874	32,200,000	853,845	59.40	13,705	0.96	137,422,563	4.27	31,860,080	0.99	8,863,579	0.28
1875	32,400,000	942,703	55.17	37,375	2.58	145,458,120	4.36	32,526,256	1.01	9,973,926	0.31
1876	32,700,000	852,438	58.39	21,540	1.47	149,132,185	4.56	33,342,288	1.02	10,428,478	0.32
1877	33,000,000	834,692	56.66	13,910	0.94	151,275,237	4.58	33,830,224	0.99	10,060,637	0.30

## COMMERCIAL AND OTHER STATISTICS OF THE UNITED KINGDOM.

Year	RICE.		TOBACCO.		TALLOW.		WINE.		BRITISH & FOREIGN SPIRITS	
	Tons	Lbs. per Head	Lbs.	Per Head	Tons	Lbs. per Head	Gallons	Per Head	Gallons	Per Head
1851	19,173	1.56	27,915,024	1.01	54,049	4.40	6,279,759	0.23	23,742,691	1.04
1852	27,601	2.24	28,418,568	1.03	58,616	4.76	6,346,061	0.23	30,051,189	1.09
1853	38,917	3.15	29,564,695	1.07	68,848	5.41	6,813,830	0.24	30,151,075	1.09
1854	41,748	3.36	30,391,841	1.09	38,001	3.06	6,776,086	0.24	30,998,057	1.12
1855	48,345	3.88	30,333,657	1.09	39,714	3.19	6,296,439	0.23	26,731,609	0.92
1856	71,032	5.65	32,413,000	1.15	50,366	4.07	7,004,953	0.25	28,284,930	1.00
1857	74,523	5.85	32,680,369	1.15	53,586	4.20	6,605,710	0.23	28,864,186	1.02
1858	88,093	6.91	34,110,851	1.19	61,259	4.80	6,697,224	0.23	27,774,347	0.97
1859	65,334	5.09	34,791,261	1.21	51,825	4.03	7,262,965	0.25	28,790,364	1.00
1860	76,778	5.94	35,412,845	1.22	71,049	5.50	7,358,189	0.25	27,066,125	0.94
1861	79,172	6.07	34,976,453	1.20	57,596	4.42	10,787,091	0.37	25,097,640	0.86
1862	132,357	10.08	35,614,985	1.21	48,519	3.70	9,083,046	0.33	24,720,614	0.84
1863	73,225	5.54	37,616,246	1.27	56,333	4.26	10,478,057	0.35	24,718,991	0.84
1864	80,518	6.05	38,239,521	1.28	49,300	3.70	11,456,715	0.38	26,544,650	0.89
1865	27,264	2.04	39,179,801	1.36	66,015	4.93	12,061,386	0.40	26,990,464	0.90
1866	48,726	3.63	40,995,161	1.36	64,518	4.81	13,227,916	0.44	29,769,868	0.99
1867	78,868	5.85	41,053,612	1.36	52,076	3.86	13,754,343	0.45	29,090,697	0.96
1868	134,729	9.91	41,280,001	1.36	57,163	4.02	15,151,741	0.50	28,610,658	0.94
1869	175,038	12.75	41,719,500	1.36	59,056	4.30	14,840,158	0.48	29,624,124	0.96
1870	92,802	6.72	41,717,012	1.34	77,879	5.32	15,168,321	0.50	31,707,609	1.02
1871	103,649	7.37	42,775,334	1.36	67,630	4.81	16,237,756	0.52	34,454,883	1.09
1872	189,796	13.39	43,948,427	1.38	60,644	4.28	16,873,955	0.53	33,618,968	1.06
1873	162,042	11.37	45,944,485	1.44	73,976	5.18	18,027,104	0.57	37,779,940	1.19
1874	144,010	10.02	45,787,816	1.40	57,575	4.01	17,284,385	0.54	40,510,613	1.26
1875	168,687	11.66	47,026,912	1.45	45,052	3.11	17,349,370	0.54	42,427,400	1.31
1876	152,742	10.46	47,681,858	1.46	63,579	4.36	18,671,089	0.57	41,796,449	1.28
1877	192,355	13.06	49,300,088	1.49	56,300	3.82	17,671,273	0.54	41,311,304	1.25

## COMMERCIAL AND OTHER STATISTICS OF THE UNITED KINGDOM.

Year.	FOREIGN WOOL		COTTON.		RAW SILK,		TOTAL VALUE OF IMPORTATIONS.	
	Lbs.	Per Head.	Lbs.	Per Head.	Lbs.	Per Head.	£	Per Head.
1851	69,581,988	2·53	645,399,389	23·44	4,059,449	0·15	Value not ascertained prior to 1856.	
1852	32,454,525	2·99	817,898,144	29·67	5,129,231	0·19		
1853	107,671,080	3·89	746,709,059	27·00	6,046,852	0·22		
1854	81,612,732	2·94	764,007,037	27·49	6,439,104	0·23		
1855	69,846,980	3·50	767,383,792	27·51	4,433,307	0·16		
1856	89,531,599	3·18	877,225,440	31·10	5,945,074	0·21	172,544,154	123/2
1857	93,262,679	3·29	837,391,296	29·53	10,371,306	0·37	187,844,441	133/5
1858	100,037,181	3·50	884,732,576	30·97	3,963,057	0·14	164,583,832	116/0
1859	104,267,884	3·62	1,050,845,836	36·52	7,768,564	0·27	179,182,355	125/5
1860	117,633,210	4·06	1,140,510,112	39·40	6,024,654	0·21	210,530,873	147/0
1861	92,795,737	3·18	958,696,816	32·84	4,613,689	0·16	217,485,024	150/2
1862	123,840,673	4·21	309,258,656	10·52	5,089,407	0·17	225,716,976	154/7
1863	113,449,703	3·83	428,230,768	14·47	5,368,226	0·13	248,919,020	169/5
1864	150,539,306	5·05	648,602,416	21·75	1,733,271	0·06	274,952,172	186/0
1865	129,761,317	4·33	675,069,360	22·75	4,586,260	0·15	271,072,285	182/2
1866	172,785,201	5·75	988,177,568	32·88	3,488,711	0·12	295,290,274	197/2
1867	142,951,240	4·73	911,910,496	30·17	3,947,634	0·13	275,183,137	182/6
1868	147,673,844	4·85	1,005,463,536	33·02	4,105,882	0·13	294,460,214	194/0
1869	141,853,383	4·61	948,298,512	30·81	2,524,215	0·08	295,460,214	192/1
1870	166,819,579	5·36	1,099,751,092	35·36	3,638,782	0·17	303,257,493	195/0
1871	184,412,542	5·73	1,406,281,520	44·64	4,961,500	0·16	330,754,359	210/0
1872	165,397,521	5·21	1,142,620,304	36·30	3,949,890	0·12	353,375,740	222/7
1873	189,824,608	6·12	1,318,087,232	41·19	2,718,322	0·09	370,380,742	230/3
1874	194,438,122	6·04	1,427,984,768	44·35	3,201,596	0·10	368,435,432	228/11
1875	189,059,859	5·84	1,233,200,864	38·00	1,939,019	0·06	373,941,125	230/10
1876	213,065,992	6·51	1,291,165,568	39·48	2,943,904	0·09	375,093,771	229/5
1877	218,546,900	6·62	1,188,365,920	36·01	2,784,453	0·08	393,941,256	238/9



## COMMERCIAL AND OTHER STATISTICS OF THE UNITED KINGDOM.

Year.	TOTAL VALUE OF BRITISH AND IRISH PRODUCE EXPORTED.		SHIPS IN FOREIGN TRADE ENTERED INWARDS.		RAILWAYS IN UNITED KINGDOM.		
	£	Per Head.	Tonnage.	Per Head.	Capital Expended.	Per Head.	Nett Profit per cent.
1851	74,448,722	54/1	7,872,094	0.28	236,841,420	172/1	3.67
1852	78,076,854	56/8	7,887,447	0.29	248,083,520	179/11	3.44
1853	98,933,781	71/6	8,943,107	0.32	263,636,320	190/7	3.80
1854	97,184,726	69/11	9,160,366	0.33	273,860,000	197/1	3.93
1855	95,688,085	68/7	8,951,239	0.32	293,903,000	210/8	3.90
1856	115,826,948	82/3	10,553,134	0.38	302,946,260	215/3	4.00
1857	122,155,237	86/2	11,475,199	0.40	311,153,670	219/5	4.19
1858	116,608,755	81/8	10,961,700	0.38	319,950,000	224/0	3.91
1859	130,411,529	90/4	11,221,922	0.39	328,219,100	228/2	4.13
1860	135,891,227	93/11	12,172,785	0.42	337,827,200	233/5	4.39
1861	125,102,814	85/8	13,179,589	0.45	352,386,100	241/4	4.30
1862	124,137,812	84/5	13,091,000	0.44	370,107,280	251/9	4.22
1863	146,602,342	99/1	13,256,063	0.45	387,246,200	270/8	4.25
1864	160,436,302	107/7	13,515,011	0.45	408,396,680	273/11	4.49
1865	165,862,402	115/1	14,317,886	0.48	433,553,100	289/0	4.46
1866	188,827,785	125/8	15,612,170	0.52	463,746,800	318/8	4.29
1867	181,183,971	120/0	14,827,617	0.49	479,167,300	317/4	4.18
1868	179,463,644	118/0	13,851,317	0.46	486,893,400	319/10	4.13
1869	190,045,230	123/7	14,485,945	0.47	490,950,770	319/4	4.45
1870	199,586,822	128/1	14,910,742	0.48	504,381,000	324/4	4.49
1871	223,066,162	141/1	16,455,342	0.52	520,400,000	330/5	4.69
1872	255,961,609	161/3	17,902,783	0.56	537,285,640	338/5	4.83
1873	255,073,336	159/5	18,791,963	0.59	569,047,346	355/8	4.75
1874	239,436,207	148/9	19,082,073	0.59	578,320,308	359/2	4.80
1875	223,494,570	138/0	19,027,827	0.58	590,223,494	361/0	4.72
1876	200,639,204	122/6	21,019,368	0.64	658,214,776	402/7	4.70
1877	198,731,073	120/4	21,197,020	0.64	690,000,000 Estimated	412/1	

# COMMERCIAL AND OTHER STATISTICS OF THE UNITED KINGDOM.

Year.	DECLARED VALUE OF GOLD, SILVER, AND SPECIE.				BANK INTER- EST.	INCOME TAX.	
	Imported.	Per Head.	Exported.	Per Head.	Annual average per cent.	Nett Amount Assessed for Property and Profits.	Per Head.
1851	Not registered prior to 1858. £		9,059,551	6/7	2.99		
1852			10,295,464	7/6	2.24		
1853			18,906,755	13/8	3.43		
1854			22,586,568	16/3	5.11		
1855			18,828,178	13/6	4.78		
1856			24,851,797	17/8	5.83	268,338,109	190/7
1857			33,566,968	23/8	6.66	274,114,003	193/4
1858	29,493,190	20/8	19,628,876	13/9	3.03	292,694,508	204/11
1859	37,070,156	25/9	35,688,803	24/10	2.74	293,666,988	204/1
1860	22,978,196	15/11	25,534,768	17/8	4.18	299,233,878	206/9
1861	18,747,045	12/10	20,811,648	14/3	5.21	301,345,865	206/5
1862	31,656,476	21/6	29,326,191	19/11	5.53	317,070,986	215/8
1863	30,030,794	20/3	26,544,040	17/11	4.40	323,949,129	218/11
1864	27,728,276	18/7	23,157,515	15/6	7.35	326,696,050	219/1
1865	21,462,211	14/4	15,210,994	10/2	4.75	349,301,654	232/10
1866	34,287,139	22/9	21,970,687	14/5	6.90	364,430,553	248/6
1867	23,821,047	15/9	14,327,289	9/6	2.54	374,342,902	247/11
1868	24,852,595	16/4	20,220,014	13/3	2.10	386,542,366	253/11
1869	20,500,991	13/4	16,391,999	16/8	3.20	389,421,002	253/3
1870	29,455,668	18/11	18,334,450	12/2	3.04	398,222,811	256/1
1871	38,140,327	24/3	33,760,671	21/5	2.88	419,850,798	266/7
1872	29,505,319	18/7	30,335,861	19/1	4.10	434,802,952	271/9
1873	33,454,724	20/11	28,899,285	18/1	4.79	453,585,000	283/6
1874	30,380,268	18/10	22,853,593	14/2	3.79	481,002,000	298/9
1875	33,264,789	20/6	27,625,042	17/7	3.24	498,260,040	307/7
1876	37,057,353	22/8	29,464,082	18/0	2.61	510,320,000	312/1
1877	37,162,534	22/6	39,798,119	24/1	2.88	520,000,000 Estimated	315/2

## MONTHLY LIST OF PATENTS.

Communicated by GEORGE DAVIES, C.E., Patent Agent, 4, St. Ann's Square, Manchester.

## ENGLISH.

## APPLICATIONS.

255. HENRY EDWARD NEWTON, 66, Chancery Lane, Middlesex. *An Improvement in centrifugal machines.* (A communication from W. H. Tolhurst, United States of America.)

301. WILLIAM MORGAN BROWN, 38, Southampton Buildings, Middlesex. *Improvements in the method of and in the apparatus for continuously evaporating cane and other saccharine juices, solution of salt and other liquids, increasing in density by evaporation.* (A communication from John H. White, of Lima, Peru.)

449. JOHN HENRY JOHNSON, 47, Lincoln's Inn Fields, Middlesex. *Improvements in the treatment of sugar, and in the apparatus employed therein.* (A communication from Dr. A. Seyferth, of Brunswick.)

456. JOHN JOHNSON, Stratford, Essex. *Improvements in the manufacture of dextrine and glucose, and in the apparatus employed therein.*

## ABRIDGEMENTS.

2444. ANDREW McONIE, of Glasgow. *Improvements in sugar cane mills.* This invention has for its object the constructing of sugar cane mills in an improved manner, and so that whilst ample strength is provided, weight is saved and the component parts are made comparatively easy of transport.

The mill is of the three-roller class, and is made with a massive cast-iron bed or base frame, on which the head-stocks, cheeks, or housings are secured. These headstocks consist of vertical wrought-iron or steel plates, of which in one modification there are four in each headstock. The cap of each bearing of the top roller is held down by four long bolts extending from the top to the bottom of the machine, and passing down between the outermost headstock plates and those next to them.

The caps of the bearings of the lower rollers are movable horizontally, and the screw bolts for securing them are fixed to the headstock plates either by means of pins passing through eyes formed on their inner ends and through strengthened eyes formed on the cheek plates, or by means of heads bearing on bridge or lug pieces fixed to the headstock plates. The headstock plates are connected by pieces of wrought iron or steel, of a channel or bar section, fixed between them, and they may also be fixed to the vertical bolts.

In another modification, each stock is formed with two plates of wrought iron or steel, and horizontal bars are rivetted or otherwise fixed in between them above and below the bearings of the lower rollers. The screw bolts for securing the caps of the bearings of the lower rollers may be connected to the horizontal bars forming part of the headstocks, or these horizontal bars may themselves be extended and have their ends screwed to receive the nuts for holding on the bearing caps. Or instead of the horizontal bars, the two plates forming each headstock may be made strong enough for the strains, and have bridge or lug pieces fixed to them for holding the bolts by which the bearing caps are secured.

The improvements admit of the lower rollers being arranged nearer to each other with advantage, whilst risk of breakage is much reduced in consequence of the tensile strains being resisted by wrought iron or steel instead of cast-iron.

JOHN CLAYTON MEWBURN, of 169, Fleet Street, London. *Improvements in apparatus for pressing and filtering beet root juice, oils, or other substances.* (A communication from Jean Marie Tissot, of Neuilly.)

This apparatus acts both as a press and a filter and is of continuous action. The substance to be operated on is introduced into the mouth of a continuous bag composed of two endless travelling cloths which approach gradually nearer together; the matter thus undergoes a progressive pressure, slight at the commencement, and attaining to the greatest pressure between pressing rollers.

The endless cloths are made in a particular manner so as to form a filter, supple under the energetic pressure which is developed and always appropriate; these filter cloths are composed of three thicknesses, the first consisting of perforated bands or straps which constitute the resisting part of the cloths; the second of coarse fabric of horse or other hair, which forms the supple and elastic part of the filter, and the last of a fine and uniform fabric, such as merino, cashmere or alpaca, which constitutes the filter properly so called.

#### JAMAICA.

WILLIAM BANCROFT ESPEUT. *Improvements in the method of treating, curing, and conveying megass or cane trash in the manufacture of sugar and in the apparatus employed therein.*

#### AMERICAN.

198346. WILLIAM CAIRNS, of Jersey City, New Jersey. *Improvements in centrifugal machines.* Centrifugal driers have been made in which the axis is allowed to move so as to accommodate itself to inequalities in the contents of the basket, and the bearings of the axis have been made so as to yield to the movement of the shaft. In this case, however, the inertia of the parts is liable to make the shaft and bearing strike in first one direction and then the other. This invention consists in making the bearings or sliding boxes with flat ends, and placing them in cross or X shaped slides, so that the bushing will be subjected to friction while sliding across between the flat ends of the opposite bearings. This detains the bushing sufficiently to prevent the said striking or thumping action against the opposite spring bearings as the shaft is revolved.

198900. WILLIAM A. MORRISON, of Frelighsburg. *Improvement in evaporating pans.* This invention relates to improvements in devices for boiling or evaporating maple sap, cane juice, sorghum, and other saccharine matter. Its object is to utilize the usually wasted steam and heat arising from the boiling sap in the evaporating pan, to render hot or cause to boil the fresh or cold supply of the same before it reaches the said pan, so that the entire superficies of the bottom of the pan may be utilized in causing the sap to be reduced to syrup. The nature of the invention consists in combining with the evaporating pan, a pipe or system of communicating pipes adapted to be placed in the pan above the sap, which being raised to the boiling point will cause the sap in the pipes to be delivered to the pan in a heated or boiling condition, thereby greatly accelerating the formation of syrup.

198943. GUSTAVUS A. JASPER, of Boston, Massachusetts. *Improvement in processes for refining raw sugar.* The improvement consists in dissolving the raw sugar to the form of exceedingly thin liquor of low temperature, and in that condition subjecting it to rapid cleansing and evaporating processes, and then treating the thick liquor resulting from the evaporation in the manner ordinarily practised in sugar refineries. Although it is preferable to apply to the liquor when it is in its thin condition such chemicals as may be of aid in clarifying the sugar, the time of so employing chemicals is not an essential element in the process, for if they are not made use of for the most part before the liquor reaches the vacuum pan in its then thick condition, the benefit will still result which comes from filtering thin liquor and boiling thick. The evaporating pan contains an excess of steam pipes, in order that evaporation of the thin liquor may go on rapidly, while the

vacuum pan has few steam pipes, in order that the boiling to form the crystal from the thick liquor may be done slowly.

198944. GUSTAVUS A. JASPER, of Boston, Massachusetts. *Improvement in apparatus for refining raw sugars.* This invention relates to a combination of apparatus for working the process described in the foregoing patent, No. 198943, and consists of apparatus for dissolving raw sugar and preparing thick liquor, comprising a mixer, warm water, and equalizing tanks, filters, evaporating pan, and necessary receiving and conducting tank pipes and pumps, in combination with apparatus for completing the process of producing refined sugar, consisting of a filter, vacuum pan, mixer, centrifugal, and necessary receiving and conducting tanks, pipes, and pumps, substantially as described.

119118. OSCAR B. STILLMAN and JOHN H. WEBSTER, of Boston, Massachusetts. *Improvement in measuring and discharging apparatus for cooling-tubes of char-furnaces.* This invention relates to apparatus for discharging bone-black or animal char as it passes from the furnaces, which revivify it after it has been used in the filtration of sugar. It consists in the combination with the cooling-tubes of measuring boxes arranged to intermittently receive, cut off the flow of, measure and discharge the char; also in a cooling tube for the measuring-box, and a bottom plate in combination with a measuring box provided with openings at bottom and top, and with a tube closing plate, to operate in connection with the lower end of the cooling tubes, whereby the box may both receive and discharge char intermittently; and also in the combination, with measuring-boxes and tube-closing plates, of mechanism to automatically move such plates to permit the char to be received automatically and intermittently.

199125. WILLIAM H. TOLHURST, of Troy, New York. *Improvement in centrifugal machines.* This invention relates to the means for supporting the upright rotary spindle upon which the basket is mounted; and it consists of journal-socket in which the basket spindle is stepped and revolved, and which socket has at its bottom a pivot end, which bears so as to be capable of rocking in a circle upon a base-step, which thus supports the spindle socket, while the latter has an annular side flange upon which is an elastic cushion, on which bears a rim-cap, that is separate from and surrounds the spindle-socket. This cap-piece is connected with and secured to the base-step by means of screws, bolts, or equivalent means, by which the spindle is adjusted in upright position, and the elastic cushion is compressed to any required degree to control the gyrating motion of the spindle without having the cushion sustain or subject to the compressing and crushing action of the great weight of the spindle-socket and spindle, with its basket and heavy contents.

### SUGAR STATISTICS—GREAT BRITAIN.

TO FEBRUARY 16TH, 1878 AND 1877. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

	STOCKS.		IMPORTS.		DELIVERIES.	
	1878.	1877.	1878.	1877.	1878.	1877.
London . . . .	91	.. 55	36	.. 33	40	.. 30
Liverpool ..	30	.. 28	25	.. 35	26	.. 24
Bristol . . . .	3	.. 3	6	.. 8	6	.. 7
Clyde . . . . .	47	.. 15	39	.. 22	32	.. 25
Total ..	171	101	106	98	104	86
Increase..	70		8		18	

STOCKS OF SUGAR IN THE CHIEF MARKETS OF THE WORLD ON THE  
1ST JANUARY FOR THREE YEARS, IN THOUSANDS OF  
TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
170	186	20	90	2	468	328	434

CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING  
1ST FEBRUARY, IN THOUSANDS OF TONS.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
868	258	27	267	154	1574	1612	1606

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE,  
FOR THE ENSUING SEASON, COMPARED WITH THAT OF THE THREE  
PREVIOUS SEASONS.

(From *Licht's Monthly Circular*.)

	1877-78.	1876-77.	1875-76.	1874-75.
	Tons.	Tons.	Tons.	Tons.
France .....	370,000 ..	243,295 ..	462,259 ..	450,877
Germany (Zollverein) ..	370,000 ..	291,204 ..	346,646 ..	250,708
Austro-Hungary ....	245,000 ..	205,267 ..	180,138 ..	140,192
Russia and Poland ..	220,000 ..	250,000 ..	245,000 ..	222,500
Belgium .....	65,000 ..	44,467 ..	79,796 ..	71,079
Holland and other Countries.....	25,000 ..	25,000 ..	30,000 ..	30,000
Total.....	1,295,000	1,059,233	1,343,839	1,165,356

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STATE AND PROSPECTS OF THE SUGAR MARKET.

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Very little change has taken place in the price of sugar during the past month, which closes with a little steadier demand. What change there is to report is in favour of sellers. The improvement in consumption, noticed last month, as compared with the same period in 1877, still continues, and the first seven weeks of the present year shows an increase of over 17,000 tons. This is the most satisfactory feature in the statistics.

The stocks of sugar, which, on the 19th January, were 72,961 tons in excess of those at the same period last year, were, on the 16th February, 69,452 tons greater than at the same period in 1877.

Raw beetroot sugar is almost unchanged in price.

The finest crystals made by refiners are cheaper; and what changes has occurred, in the price of refined, has reduced the margin available for expenditure on raw sugar, although French loaves are quoted 3d. dearer since our last report. The position, on the whole, remains much as it was last month, and we do not see any cause for anticipating much change at present.

Present quotations of the standard qualities are as under:—  
Porto Rico, fair to good refining, 21s. to 21s. 6d., against 21s. to 21s. 6d.; good to fine grocery, 22s. 6d. to 25s., against 22s. 6d. to 25s.; Martinique crystals, 27s. to 27s. 6d., against 27s. 6d. to 28s.; No. 12 Havana, 23s. to 23s. 6d., against 23s. to 23s. 6d.; fair to good refining Cuba Muscovados, 21s. to 21s. 6d., against 21s. 6d. to 22s.; middling to good brown Bahia, 19s. 6d. to 20s. against 18s. 6d. to 19s.; good to fine Pernambuco, 20s. to 20s. 6d., against 19s. 6d. to 20s. 6d.; Paris loaves, 28s. to 28s. 9d., against 27s. 9d. to 28s. 6d.

# THE SUGAR CANE.


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No. 105.

APRIL 1, 1878.

Vol. X.

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 The writers alone are responsible for their statements.

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## SUGAR DRAWBACKS IN RUSSIA.

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The West India Committee have been kind enough to place the following documents at our disposal. The past and still untiring efforts of the Committee, against the protective system of drawbacks, entitle them to the best thanks not only of our sugar-producing colonies (which they more directly represent), but of British refiners as well. We greatly fear, however, that their labours will prove to have been in vain, unless our Government can be induced to solve the difficulty by imposing such countervailing duties on all bounty-fed sugars as will nullify its effects. We ask for no other advantage than to be placed upon a footing of equality with our foreign competitors, and we have little hope that this can be secured to us by any other means. Conferences, and their resulting Conventions, have hitherto been productive of little more than disappointment; and indeed nothing better can reasonably be looked for, where so many separate interests have to be conciliated, each country contending for some particular system for its own gain and the over-reaching the rest, England excepted, which only seeks for equality. Countervailing duties would effectually settle the matter; but must be applied without delay, if they are to save our colonies, and allied interests at home, from impending ruin:—



## FOREIGN OFFICE TO WEST INDIA COMMITTEE.

January 14th, 1878.

*The Secretary the West India Committee.*

Sir,—I am directed by the Earl of Derby to transmit to you herewith, for the information of the West India Committee, a copy of the Report on the subject of Bounties on Sugars exported from Russia, which you were informed in the letter from this office of the 1st ulto. that Her Majesty's Ambassador at St. Petersburg would be requested to supply.

I am, &amp;c.,

(Signed) T. V. LISTER.

[NOTE.—The English equivalents for Russian weights and moneys, interpolated in Mr. Michell's Report, were added in London, by the West India Committee.]

## SUGAR DRAWBACKS IN RUSSIA.

*Report by Mr. Michell on the Manufacture of Sugar in Russia.*

The bounty or drawback at present allowed by the Russian Government on native manufactured sugar exported out of the country is:—

On refined lump and raw white, £7 10s. 4d. per ton, 80 copecks per pound,  
2s. 5d. per 36lbs.

On raw medium, £6 9s. 8d. per ton, 70 copecks per pound, 2s. 1d. per 36lbs.

On raw brown, £4 3s. per ton, 45 copecks per pound, 1s. 4d. per 36lbs.

According to a decision of the Minister of Finance, promulgated in August last, drawbacks on the above scale will continue to be paid on exported sugar until the 1st of May, 1878, when the expediency of either reducing the present rates or abolishing them altogether will probably be taken into consideration.

Since the establishment of the increased rates of drawbacks on sugar, in October, 1876, the sugar industry in Russia has largely developed, and a great impetus has been given to the exportation of Russian manufactured sugar to foreign countries. According to the last Russian customs returns, which comprise a period of nine months of the present year—i. e., from the 1st January to the 1st of October, 1877, 3,180,846 pounds (51,120 tons) of raw, and 178,439 pounds (2868 tons) of refined lump sugar were exported from Russia during that time; the exportation of this commodity having been, during the last and other preceding years, altogether insignificant. In

addition to the premium offered to the native manufacturer, in the shape of a high bounty on his exported produce, the disposal of Russian sugar abroad was favoured by the scarcity of French and other beet sugars in the market, and the consequent high prices that prevailed. The low rate of exchange existing between Russia and foreign countries this year has also tended to increase exportation of sugar, particularly to England, where, it is said, Russian grown sugar has found great favour, owing to its good quality. Further encouragement was afforded to Russian sugar manufacturers last year by the advance to a syndicate of such manufacturers of 3,000,000 roubles (£450,000) by the State Bank, on very favourable terms. This loan has not yet been refunded to the bank, and the period for its repayment has been extended over a considerable time.

The prospects of the Russian export trade on sugar for next year are reported to be very encouraging, the crop last year having yielded good results. In all other branches of manufacturing industry great depression and stagnation prevail; sugar manufacturers in Russia, therefore, owing to exceptional circumstances, can alone anticipate continued prosperity during the forthcoming year. All their old stocks, both of raw and refined sugar, have already been disposed of, and they expect to receive large orders for the produce of this year's crop.

Notwithstanding the increased exportation of Russian sugar, under existing high rates of bounty, the price for sugar has not risen in Russia, proving that the supply of that article for home consumption has not diminished by increase of exportation. This is evidenced by the following figures, showing the increased revenue derived by the Government under the head of excise duty levied on native sugar:—

TOTALS OF AMOUNT OF EXCISE DUTY RECEIVED ON HOME-GROWN  
SUGAR.

	Roubles.	£
1872 .....	2,147,855	322,178
1873 .....	3,775,242	566,286
1874 .....	3,760,798	564,120
1875 .....	3,086,877	462,956
1876 .....	4,850,808	727,621
1877 (anticipated revenue).....	5,700,000	855,000

The official trade returns from the 1st January to the 1st October of the present year show, as might naturally be expected under the circumstances, a very great diminution in the quantity of cane sugar imported into Russia, the decrease under this head amounting to no less than 436,897 pounds (7022 tons). The following are the exact figures showing this diminution:—

	Pounds.	Tons.
Quantity of Cane Sugar imported in 1876.....	437,999	7039
"              "              "              1877.....	1,102	18

Cane sugar had hitherto been chiefly imported to St. Petersburg, where several large refineries were in existence. These, however, have been nearly all abandoned, and those that still continue to exist at the present moment are mostly employed in refining the native raw material, the market price at St. Petersburg of raw cane sugar being no longer able to compete with that ruling for native beet.

The sugar manufactories in Moscow are exclusively refineries of raw beet sugar, which is obtained from the provinces of Kiev, Kharkov, Tchernigov, and the Ukraine. There are four such refineries in Moscow, and their annual yield, according to reliable accounts, amounts to 1,800,000 pounds.

In the Grand Duchy of Finland there are only two refineries, namely, one at Helsingfors and the other at Abo, producing jointly refined sugar to the value of 4,500,000 marcs, or about £180,000 sterling. The raw material employed by these manufactories is imported from abroad. No excise is levied on refined sugar in Finland, and as no sugar is exported out of the country, no drawbacks are consequently granted in the duchy. Since the commencement of this year a considerable quantity of Russian sugar has been exported from Russia proper to Finland, in consequence of the extension of the systems of drawbacks to the Russo-Finland frontier. The effect of this measure must necessarily be to destroy altogether the native Finnish sugar industry, which, as already stated, has hitherto received its supply of raw material from foreign countries, under a comparatively high rate of customs duties.

Siberia, which has hitherto drawn her supplies of sugar from European Russia, will soon be able to provide herself with her wants

in respect to sugar out of her own produce. The difficulties of transport, and the consequent enhancement of the price of the commodity to the local consumer, have induced some enterprising Siberian merchants to establish a sugar manufactory at Minusinsk, in Eastern Siberia, in the neighbourhood of which town beetroot can be successfully cultivated.

(Signed) JOHN MICHELL, *Consul.*

*St. Petersburg, December 19, 1877.*

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### CONFERENCIA AGRICOLA.

POR DON SANTIAGO McCORMICK, Ponce, Puerto-Rico, 1877.

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This is a very interesting little work of some 50 pages, in 4to, which has found its way to us from the island of Porto Rico. It is a public lecture given by Señor Santiago McCormick, at the Theatre of *La Perla*, in Ponce, under the patronage of the Agricultural Society of that town, of which the author is one of the most distinguished members. The subject of the lecture is the cultivation of the sugar cane in that island, and we glean from the public papers that it was listened to with the greatest attention and received with enthusiastic applause by a very numerous audience.

In a modest introduction, the author informs his hearers that for the last 30 years he has made the culture of the sugar cane his special study, from a purely scientific point of view; and, though he does not wish to find fault with anything or anybody in particular, he hopes to be able to lay before them certain facts and truths of an important nature and practical character.

We have read the pamphlet with considerable interest from beginning to end, and feel bound to assert that it may fairly claim to rank among the most useful publications of the kind that we have met with of late years. After paying a well-deserved compliment to the Agricultural Society of Ponce, Señor McCormick states that this society will eventually succeed in staying the prostration of cane husbandry in Porto Rico, by fostering a love of scientific agriculture throughout the island.

An interesting sketch of the discovery of sugar in the beet-root by Marggraf, leads the author to compare the wonderful development of that plant, from an agricultural point of view, with that of the sugar cane, and to intimate that the latter will probably repay most amply a similar application of scientific methods, arriving at the conclusion that if we wish to increase our yield of sugar we must make it in the field. Instead of improving, as the beet has done during the last 30 years, Señor Don Santiago McCormick is of opinion that the cane has rather deteriorated; certainly such appears to be the case in Porto Rico, where, notwithstanding this, the yield of sugar per acre is large, as compared with many other West Indian localities. Still he shows clearly how much must be done if cane culture is to continue in that island. People assert that the cause of this deterioration resides in the fact that the climate has changed. This is not the case; the climate is as good as ever; there are no more inundations—no more droughts than formerly; but the soil has deteriorated by long culture, and it has now become very difficult to produce canes with a rich saccharine juice. This, however, should be the aim of every planter, and the author proceeds to show how it may be done. After devoting considerable space to the subject of water and irrigation, insisting especially upon the importance of the latter during the dry seasons, and showing how easily it can be carried out, he proceeds to point out the necessity of proper manures and of proper tillage, without which the roots of the cane cannot travel to any distance in search of nourishment, and the soil cannot receive the proper amount of air. He next examines the action of light, and the proper method of planting; also, the necessity of choosing good plants, following Darwin's doctrine of selection, and reproducing several modern notions communicated from time to time to our columns by Dr. Phipson and other writers on the agricultural chemistry of the cane.

One cause of the bad state of cane culture in Porto Rico appears to reside in the ambition of planters to cultivate large estates. The author rightly asserts that it is far more profitable to cultivate a small field well than a large one badly. Then he says that the

planters of that island would do well to cultivate the gift of calculation, and really ascertain with accuracy what they are doing.

A large portion of the lecture is devoted to the modern improvements in sugar making, in which the old and new systems are compared, and the Concretor and vacuum-pan discussed, together with the question of mills and rolls, the application of galvanism advocated by Gill, the improvements proposed by Tooth, Eastes, Stolmeyer, &c., &c., for all of which we have no space here.

The lecture concludes by exhibiting the author's new method of planting and preparing the soil, by which the most extraordinary results have been obtained within the last few years. The soil properly tilled, and worked as deep as possible, receives the plants at such a distance apart that the roots of one cane, when full grown, can never interfere to any extent with those of another. At two or three months old, each plant receives three ounces of the fertilizer known as the "urban cane manure," and in five months time each cane receives five ounces more of the same manure. Precautions are also taken for irrigation in dry seasons, and various other matters, especially light and air, are attended to.

In concluding this notice, we may observe that in this closely-printed 4to pamphlet of no more than 50 pages there is the matter of a good-sized volume, in which the whole subject of cane culture and sugar making is placed before the reader in a clear and interesting manner. We do not hesitate to recommend it warmly to those of our readers who are acquainted with the Spanish language, and wish it had been in our power to devote more space to its valuable contents.

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EASTES' PROCESS.—Delightfully cool weather, with frequent showers, have during the past week done much to efface the traces of drought, and should tend eventually to bring down the price of maize. Cane crushing has been recommenced at Redland Bay Plantation, where a trial was last week made of the clarifying process invented by Mr. C. Eastes, of this town. The trial, which was conducted under the immediate supervision of Mr. Eastes, lasted for three days, and was attended with marked success, the sugar manufactured being from £3 to £4 per ton superior to any previously made on the estate. In connection with the peculiar character of the soil at Redland Bay, and on other plantations in that vicinity, a difficulty has hitherto arisen in obtaining sugar of a good colour, although the grain has always been first-class. It has been reserved for Mr. Eastes to prove that this difficulty is not insurmountable.—*Queenslander*, Brisbane.

## ON AREOMETERS.

By P. CASAMAJOR.

Read before the American Chemical Society, May 3rd, 1877; and sent, by favour of the Author, for insertion in this Magazine.

(Continued from page 154.)

## PART II.

*Correction of the Indications of Areometers for errors resulting from variations of temperature.*

The methods that I propose to give for the correction of the indications of areometers, when observations are made at temperatures differing from the normal, are applicable to all liquids, but, as I am not in possession of accurate data relating to the expansion of other liquids than pure water and sugar solutions, I shall confine myself to these. The application to any other liquid, however, is equally easy, if we possess sufficient data on its expansion by heat.

I propose to consider temperatures from 5° to 45° C. only, as these limits need never be exceeded in our laboratories.

At our December meeting\* I gave the following table, of which the first column contains the degrees Centigrade from 5° to 45°; the the numbers of the second column represent the total *absolute* contractions and expansions of 1 C.C. of water at every degree of temperature, starting from 15° C. as a normal, and the numbers of the third column represent the total *relative* expansions and contractions for the same temperatures. These last numbers were obtained by subtracting 0.000026, the cubic expansion of glass, as many times from the corresponding numbers of the second column, as there are units *minus* 15, in the number expressing the degree Centigrade. The numbers in this third column represent the visible expansion of water in glass vessels.

\* See *Chemical News* of April 20 (No. 908), and April 27, 1877 (No. 909.)

TABLE No. 1.—TOTAL EXPANSION FROM 15° C.

Degree C.	Absolute Expansion.	Relative Expansion.	Degree C.	Absolute Expansion.	Relative Expansion.
5°	0·000878	0·000612	26°	0·002445	0·002159
6°	0·000856	0·000622	27°	0·002717	0·002405
7°	0·000820	0·000612	28°	0·002995	0·002657
8°	0·000772	0·000590	29°	0·003279	0·002913
9°	0·000706	0·000550	30°	0·003569	0·003179
10°	0·000622	0·000492	31°	0·003869	0·003453
11°	0·000524	0·000420	32°	0·004181	0·003739
12°	0·000412	0·000334	33°	0·004503	0·004035
13°	0·000288	0·000236	34°	0·004836	0·004342
14°	0·000150	0·000124	35°	0·005180	0·004660
15°	Normal.	Normal.	36°	0·005533	0·004987
16°	0·000173	0·000147	37°	0·005895	0·005323
17°	0·000357	0·000305	38°	0·006265	0·005667
18°	0·000551	0·000473	39°	0·006644	0·006040
19°	0·000756	0·000652	40°	0·007032	0·006382
20°	0·000971	0·000841	41°	0·007428	0·006752
21°	0·001119	0·001039	42°	0·007832	0·007130
22°	0·001428	0·001246	43°	0·008244	0·007516
23°	0·001670	0·001462	44°	0·008664	0·007910
24°	0·001920	0·001686	45°	0·009092	0·008312
25°	0·002179	0·001919			

Referring again to the paper read before this Society in December, I will recall to your memory that by drawing a series of parallel equi-distant lines, intersected by another series of similar lines perpendicular to the first; by making the space between two vertical lines equivalent to 1° Centigrade, and the space between two horizontal lines equivalent to 0·0001 C.C., we were able to simplify the work of correcting the errors due to changes of temperature. We took on every vertical line a distance equivalent to the relative expansion corresponding to the temperature represented by that line, and we connected all the points thus obtained by a curve. Afterwards, by noting the points at which the curve intersects the horizontal lines representing 0·0005, 0·001, 0·0015, 0·002, 0·0025, &c., we were able to find the temperatures corresponding to these expansions as follows:—



TABLE No. 2.

—0.0005 corresponds to 9°·9 Centigrade.

0.	“	“	15°	“
0.0005	“	“	18°·2	“
0.001	“	“	20°·75	“
0.0015	“	“	23°·2	“
0.002	“	“	25°·3	“
0.0025	“	“	27°·3	“
0.003	“	“	29°·4	“
0.0035	“	“	31°·2	“
0.004	“	“	32°·8	“
0.0045	“	“	34°·5	“
0.005	“	“	36°·1	“
0.0055	“	“	37°·6	“
0.006	“	“	38°·8	“
0.0065	“	“	40°·4	“
0.007	“	“	41°·6	“
0.0075	“	“	42°·9	“
0.008	“	“	44°·2	“
0.0083	“	“	45°	“

To enable us to make use of the data contained in Tables No. 1 and No. 2, let us examine what happens with an areometer floating in a liquid, when the density of the liquid varies on account of a change of temperature.

If we suppose that the temperature increases, the liquid will expand, and the areometer also, but everything will take place as if the volume of the areometer remained constant, and the expansion of the liquid was equal to the relative expansion of water in glass.

If we have an areometer which indicates specific gravities, and if we place it in pure water, at the normal temperature, 15° C., the instrument will sink to a point marked 1. If the temperature increases, the specific gravity of the liquid diminishes and the areometer sinks deeper in the liquid. If, for instance, the temperature of the water is 35° C., we will find in the third column of Table No. 1 that at 35° 1 C.C. becomes 1.00466, consequently at 35°, the specific gravity of water is  $\frac{1}{1.00466} = 0.9953$ . As, before we have done with this subject, we shall have to correct the errors due to variations of temperature in the case of pure water, please to observe that, if the temperature is 35° C., and the indication of the

areometer 0.9953, we will obtain the true specific gravity by multiplying 0.9953 by 1.00466.

I may also call to your attention that the correction may be more easily made by simply adding 0.00466 to 0.9953, which gives 0.99996, which is very approximately equal to 1.

If we wish to make use of Table No. 2, let us suppose that the temperature is  $20^{\circ}75$ , at which 1 C.C. becomes 1.001 C.C. The specific gravity will then be  $\frac{1}{1.001} = 0.99908$  (very approximately 0.999). In this case we may rectify this indication of the areometer by multiplying it by 1.001. Please to notice, however, that the correction is, as above, more easily obtained by adding to 0.999 the number 0.001, placed opposite to  $20^{\circ}75$  ( $0.999 \times 0.001 = 1$ ).

In the same way, if the temperature is  $44^{\circ}2$  C., we find, opposite to it, the expansion 0.008, and the specific gravity of water becomes  $\frac{1}{1.008} = 0.99206$ , very approximately 0.992. We may notice, again, that the correction is easily made by adding to 0.992, the expansion 0.008 placed opposite  $44^{\circ}2$  C.

We may then make use of Table No. 2 by simply adding the numbers opposite to the temperatures observed, to obtain the correct reading at  $15^{\circ}$  C., in the case of pure water.

In the table marked No. 2 we have not, as in Table No. 1, every degree of the scale, but as the expansions corresponding to the temperatures in that table only differ by a quantity equal to 0.0005 C.C., no appreciable error is committed by taking the temperature in the table which comes nearest to the temperature observed.

Let us now take the case of an areometer with an even scale, and examine what happens when the liquid in which it floats is submitted to a change of temperature. If we had an areometer which would sink in pure water at  $15^{\circ}$  C., so that the liquid displaced was equal to 1 C.C., when the temperature of the water increased, it would sink deeper, the extra volume of liquid displaced being equal to the relative expansion at the temperature observed, as shown in the third column of Table No. 1. If the volume of water displaced at  $15^{\circ}$  was 2 C.C., the increased volume of water to buoy up the areometer would be, for any temperature, the relative expansion of 1 C.C. at that temperature multiplied by 2. In more general terms,

if the volume of water displaced at  $15^{\circ}$  C. was  $N$  cubic centimeters, the additional volume at any temperature would be the relative expansion at that temperature, multiplied by  $N$ .

We have seen, however, that the divisions of an even scale are only equal volumes into which the total volume of the areometer is divided. Therefore, if we have an areometer with a total number of degrees,  $N$ , we may obtain the correction in degrees at any temperature by multiplying the total relative expansion at that temperature (Table No. 1, third column) by  $N$ , the total number of degrees.

In the preceding remarks, I have always supposed that the temperature observed was above  $15^{\circ}$  C. If the temperature is below  $15^{\circ}$ , a contraction takes place, which is to be subtracted.

We may now proceed to apply the principle I have established to the correction of errors due to changes of temperature in the case of sugar solutions.

In a paper, *On the Expansion of Sugar Solutions by Heat*, published in *American Chemist*, for June, 1874, (Vol. IV., p. 447,) and in *The Sugar Cane*, for September, 1874 (Vol. VI., p. 455), I gave a detailed account of the researches I was obliged to make to ascertain the expansion of sugar solutions up to the solution containing 23 per cent. of sugar. As my object was limited to solutions which can be introduced directly in the tube of the saccharometer, I did not, at that time, go beyond 23 per cent. of sugar. The extreme temperatures were  $5^{\circ}$  and  $45^{\circ}$  Centigrade. I took a certain volume of liquid at  $5^{\circ}$ , and ascertained the total expansion from  $5^{\circ}$  to  $45^{\circ}$ , and afterwards divided this expansion by 40, the total number of degrees, and by the volume at 5 in cubic centimeters, the result being the mean expansion of 1 C.C. for every degree between these limits of temperature. The expansion of pure water was ascertained in this way, also that of sugar solutions containing  $11\frac{1}{2}$  per cent. and 23 per cent. of sugar.

The mean relative expansion of 1 C.C. of water for every degree Centigrade between  $5^{\circ}$  and  $45^{\circ}$  was found to be 0.00021;\* that of

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\* For the sake of comparison, we may add the total relative expansion from  $15^{\circ}$  to  $45^{\circ}$  (0.009312) to the total relative contraction from  $15^{\circ}$  to  $5^{\circ}$  (0.000612), as found in the third column of Table No. 1, and divide the sum,

the solution containing 23 per cent. of sugar was 0.00023, and the solution containing  $11\frac{1}{2}$  per cent., instead of giving the average 0.00022, gave repeatedly 0.000215. As this latter number did not depart very sensibly from the average, I had a right to conclude that the intermediate numbers followed materially the same laws as the extremes.

To apply the expansion 0.00021 to the areometer which I use for testing sugar solutions, we must remember that we found for this areometer  $N=260$ ; therefore the average expansion for an increase of  $1^{\circ}$  C. is  $260 \times 0.00021 = 0.0546$  degree.

If we place the same areometer in a solution  $23^{\circ}$  Balling, the submerged portion is  $260^{\circ} - 23^{\circ} = 237$  degrees Balling, and the average expansion in this case is  $237 \times 0.00023 = 0.0545$ . As we have admitted that the intermediate solutions follow materially the same laws as the extremes, we arrive at this remarkable result: *that the mean correction for variation of temperature is the same for sugar solutions up to 23 per cent. of sugar as for water.* Now, if we remember that the graduation of a Balling areometer increases downward, so that the deeper the instrument sinks the less is the degree indicated; and if we admit that the expansion from degree to degree is 0.0545, we may see that the indication at any temperature may be restored to that corresponding to the normal by adding 0.0545 as many times to the observed indication as there are degrees between the observed temperature and the normal.

If  $15^{\circ}$  is the normal, at  $16^{\circ}$  we would have to add 0.0545, at  $17^{\circ}$  0.109, at  $18^{\circ}$  0.163, &c. Between  $12^{\circ}$  and  $27^{\circ}$  C., to which I always brought the temperature of my solutions, the error committed by taking a uniform expansion does not exceed 0.087.

I have, however, more recently calculated the expansion of water for every degree C. Taking  $15^{\circ}$  C. as a normal, the numbers of the following table, No. 3, were obtained by multiplying the relative expansions as given in the third column of table No. 1 by 260. Table

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0.008924, by 40, which gives 0.000223. The number is very nearly the same as the one I found directly. If we consider the series of operations by which the numbers 0.008312 and 0.000612 were obtained, as explained in the paper read before this Society in December, the coincidence, or *quasi* coincidence, is certainly satisfactory.

No. 4 is calculated by taking  $17\frac{1}{2}^{\circ}$  C. as a normal, to be used for areometers made in Germany, as these are based on  $17\frac{1}{2}^{\circ}$  C. ( $14^{\circ}$  R.)

TABLE No. 3.—CORRECTIONS OF BALLING'S AREOMETER.  
(Normal Temperature  $15^{\circ}$  C.)

Degree Centigrade.	Correction of the Areometer.	Degree Centigrade.	Correction of the Areometer.	Degree Centigrade.	Correction of the Areometer.
$5^{\circ}$	0.159	$19^{\circ}$	0.169	$33^{\circ}$	1.049
$6^{\circ}$	0.161	$20^{\circ}$	0.218	$34^{\circ}$	1.128
$7^{\circ}$	0.159	$21^{\circ}$	0.269	$35^{\circ}$	1.212
$8^{\circ}$	0.153	$22^{\circ}$	0.323	$36^{\circ}$	1.297
$9^{\circ}$	0.143	$23^{\circ}$	0.380	$37^{\circ}$	1.384
$10^{\circ}$	0.127	$24^{\circ}$	0.438	$38^{\circ}$	1.473
$11^{\circ}$	0.109	$25^{\circ}$	0.506	$39^{\circ}$	1.570
$12^{\circ}$	0.086	$26^{\circ}$	0.567	$40^{\circ}$	1.659
$13^{\circ}$	0.062	$27^{\circ}$	0.631	$41^{\circ}$	1.755
$14^{\circ}$	0.032	$28^{\circ}$	0.697	$42^{\circ}$	1.854
$15^{\circ}$	Normal.	$29^{\circ}$	0.764	$43^{\circ}$	1.954
$16^{\circ}$	0.038	$30^{\circ}$	0.833	$44^{\circ}$	2.054
$17^{\circ}$	0.079	$31^{\circ}$	0.898	$45^{\circ}$	2.158
$18^{\circ}$	0.123	$32^{\circ}$	0.972		

TABLE No. 4.—CORRECTIONS OF BALLING'S AREOMETER.  
(Normal Temperature,  $17\frac{1}{2}^{\circ}$  C.)

Degree Centigrade	Correction of Areometer.	Degree Centigrade	Correction of Areometer.	Degree Centigrade	Correction of Areometer.
$5\frac{1}{2}^{\circ}$	0.262	$19\frac{1}{2}^{\circ}$	0.083	$33\frac{1}{2}^{\circ}$	0.983
$6\frac{1}{2}^{\circ}$	0.263	$20\frac{1}{2}^{\circ}$	0.143	$34\frac{1}{2}^{\circ}$	1.037
$7\frac{1}{2}^{\circ}$	0.261	$21\frac{1}{2}^{\circ}$	0.193	$35\frac{1}{2}^{\circ}$	1.120
$8\frac{1}{2}^{\circ}$	0.252	$22\frac{1}{2}^{\circ}$	0.250	$36\frac{1}{2}^{\circ}$	1.204
$9\frac{1}{2}^{\circ}$	0.243	$23\frac{1}{2}^{\circ}$	0.308	$37\frac{1}{2}^{\circ}$	1.344
$10\frac{1}{2}^{\circ}$	0.228	$24\frac{1}{2}^{\circ}$	0.367	$38\frac{1}{2}^{\circ}$	1.381
$11\frac{1}{2}^{\circ}$	0.208	$25\frac{1}{2}^{\circ}$	0.428	$39\frac{1}{2}^{\circ}$	1.473
$12\frac{1}{2}^{\circ}$	0.183	$26\frac{1}{2}^{\circ}$	0.492	$40\frac{1}{2}^{\circ}$	1.573
$13\frac{1}{2}^{\circ}$	0.157	$27\frac{1}{2}^{\circ}$	0.557	$41\frac{1}{2}^{\circ}$	1.664
$14\frac{1}{2}^{\circ}$	0.110	$28\frac{1}{2}^{\circ}$	0.622	$42\frac{1}{2}^{\circ}$	1.762
$15\frac{1}{2}^{\circ}$	0.076	$29\frac{1}{2}^{\circ}$	0.700	$43\frac{1}{2}^{\circ}$	1.862
$16\frac{1}{2}^{\circ}$	0.040	$30\frac{1}{2}^{\circ}$	0.765	$44\frac{1}{2}^{\circ}$	1.964
$17\frac{1}{2}^{\circ}$	Normal.	$31\frac{1}{2}^{\circ}$	0.832	$45\frac{1}{2}^{\circ}$	2.079
$18\frac{1}{2}^{\circ}$	0.045	$32\frac{1}{2}^{\circ}$	0.907		

To make use of either of these tables, we place a Balling's areometer in a sugar solution, and note the degree and tenth of degree indicated, and afterwards place in the same solution a thermometer, and note the temperature. Opposite to the temperature observed, we find the number to be added to the indication of the areometer, if above the normal, or to be subtracted, if below.

If we take  $15^{\circ}$  C. as a normal, and the areometer gives  $12^{\circ}8$ , while the thermometer shows  $20^{\circ}$ , the correction in Table No. 3 is 0.218, which is added to 12.8, giving 13.018.

We may, however, correct the indication of the Balling areometer in a simpler and quicker way by using a method entirely analogous to that which I gave for volumetric analysis in the paper read before this Society in December.

This consists in erecting a series of vertical equidistant lines, the space between two of which corresponds to  $1^{\circ}$  C. and intersecting these lines by a series of equidistant lines perpendicular to the first, the distances between two of which we may make equivalent to  $0^{\circ}01$  Balling. We may then, adopting either  $15^{\circ}$  or  $17\frac{1}{2}^{\circ}$  C. as a normal, take on every vertical line a distance corresponding to the hundredths of a degree, as found in the second column of Table No. 3 or No. 4, and afterwards connect the points thus obtained by a curve. By finding the points at which this curve intersects the horizontal lines corresponding to 0.1, 0.2, &c., of a degree, and noting the temperatures at these intersections, we form Table No. 5 for  $15^{\circ}$  C. as a normal, and Table No. 6 for  $17\frac{1}{2}^{\circ}$  C. as normal. We may notice that, in Table No. 5, the correction  $\times 0.1$  happens at  $17\frac{1}{2}^{\circ}$  C., so that Table No. 6 is easily obtained by subtracting 0.1 from the indications of the preceding table.

We may, instead of either of these tables, use a thermometer with an ivory scale, having on one side of the mercury column, the degrees C., and, on the other side, the numbers in the second column of either Table No. 5 or Table No. 6, exactly as for the thermometer which I described in detail in the paper read before this Society in December.

TABLE No. 5.

TABLE No. 6.

Degree Centigrade.	Degree Balling to be added.		Degree Centigrade.	Degree Balling to be added.
9°·5	—0·15		9°·5	—0·25
11°·8	—0·1		11°·8	—0·2
15°	Normal.		15°	—0·1
17°·5	0·1		17°·5	Normal.
19°·7	0·2		19°·7	0·1
21°·6	0·3		21°·6	0·2
23°·4	0·4		23°·4	0·3
25°·2	0·5		25°·2	0·4
26°·7	0·6		26°·7	0·5
28°·2	0·7		28°·2	0·6
29°·5	0·8		29°·5	0·7
31°	0·9		31°	0·8
32°·5	1·		32°·5	0·9
34°	1·1		34°	1·
35°	1·2		35°	1·1
36°·4	1·3		36°·4	1·2
37°·7	1·4		37°·7	1·3
38°·8	1·5		38°·8	1·4
40°	1·6		40°	1·5
40°·7	1·7		40°·7	1·6
41°·8	1·8		41°·8	1·7
43°	1·9		43°	1·8
44°	2·		44°	1·9
45°	2·1		45°	2·

If, instead of the areometer giving the percentage of sugar, we wish to use one giving the specific gravities, we must remember that, in the case of water, we may use Table No. 2 by simply adding the numbers opposite to the temperatures observed to obtain the correct reading at the normal temperature. We have shown, besides, that for Balling's areometer *the correction of temperature is the same for all sugar solutions up to 23 per cent. of sugar as for water.* Therefore for any sugar solution, up to sp. gr. 1.1., we have merely to add the numbers opposite to the temperatures observed, as found in Table No. 2, to restore the indication of the areometer to the specific gravity at 15° C.

If, as it is usual in Germany, we take 17½° C. as a normal, we may use the following table, No. 7.

TABLE No. 7.

Degree Centigrade.	Quantity to add to sp. gr.	Degree Centigrade.	Quantity to add to sp. gr.
7.5	—0.001	34.7	0.004
13.0	—0.0005	36.2	0.0045
17.5	0.	37.4	0.005
20.2	0.0005	39.0	0.0055
23.0	0.001	40.5	0.006
25.0	0.0015	42.0	0.0065
27.0	0.002	43.4	0.007
29.0	0.0025	44.2	0.0075
31.0	0.003	45.0	0.008
32.5	0.0035		

As in previous cases, we may, instead of using the Tables No. 2 and No. 7, write the corrections directly on the ivory scale of a thermometer on one side of the column of mercury, opposite to the corresponding temperature on the other side.

In describing the methods that I have given for correcting the errors in the indications of areometers in the case of sugar solutions up to the solution holding 23 per cent. of sugar, I have proved that the total correction for expansion is the same as for pure water from 5° to 45° C.; but I have not afforded any proof that sugar solutions vary in expansion from degree to degree in a manner exactly parallel to the expansion of water, although I have assumed that such is the case. I can say, however, that I have the best of reasons for knowing that no appreciable error is committed by this assumption, for, by making a great number of tests of the same sugar at different temperatures and at different degrees of dilution, I have repeatedly obtained the same co-efficient of purity within less than  $\frac{1}{2}$  per cent. As such facts have presented themselves hundreds of times in my practice, I have no hesitation in recommending the method I have given for solutions within the limits mentioned.

This conclusion is confirmed by what happens when a solution containing  $11\frac{1}{2}$  per cent. or 23 per cent. of sugar is placed in a dilatometer and cooled down to 5° C., and afterwards the dilatometer is placed in a water bath kept at 45° C. The volume of the solution



increases at first very slowly, but gradually the rate of increase, for equal spaces of time, becomes greater, and, towards the end, the increase of volume is very rapid. As the rate at which the temperature of the solution increases is proportional to the excess of the temperature of the bath over that of the contents of the dilatometer, the rate of increase of temperature is greater at first than towards the end. This circumstance renders the increase of the rate of expansion towards the end more remarkable, and shows that the law of expansion for these sugar solutions is very nearly the same as for water.

As to thicker sugar solutions, I have lately determined the expansion of the solution of specific gravity 1.192 (23°·2 Baumé), and that of the solution of specific gravity 1.3116 (34°·2 Baumé), between 5° and 45° C., which are given in the table below. To compare the corrections to be made with areometers of even scales, in the case of these expansions, with the corrections in the case of solutions containing 23 per cent. of sugar or less, I have expressed the densities of all these solutions in Baumé degrees, as Baumé's areometer, in which  $N = 144$  is commonly used for sugar solutions of all kinds, while the areometer in which  $N = 260$  is only suitable for weak solutions, as I have already explained (April meeting).

Degree Baumé.	Average expansion of 1 C.C. between 5° and 45° C.	Number of areometer degs. submerged.	Correction— Product of 2nd by 3rd column.
0°	0.00021	144	0.03024
13° (23% Sugar).	0.00023	131	0.03013
23°·2	0.00028 $\frac{1}{2}$	120·8	0.03473
34°·2	0.000328	109·8	0.03601

We may see in this table that at 0 and 13° Baumé the correction is materially the same as I have shown for the areometer in which  $N = 260$ .

In the case of thicker solutions, up to 34° Baumé, we may also see that the corrections are represented by larger numbers, and we are naturally led to inquire whether for such solutions we may stil

correct the indications of areometers by using the tables I have given this evening without incurring the risk of committing serious errors.

As the error committed would be the greatest with a solution of  $34^{\circ}\cdot 2$  Baumé, we may find the maximum error by calculating on the base of a mean correction for every degree Centigrade  $= 0^{\circ}\cdot 03601$ , and supposing that the observation is taken at  $45^{\circ}$  C. The total correction in this case is  $0^{\circ}\cdot 03601 \times 30 = 1^{\circ}\cdot 088$ , while, if the mean correction for every degree C. is  $0\cdot 0302$ , the total correction is  $0\cdot 0302 \times 30 = \cdot 906$ ; the difference,  $0\cdot 177$ , is the maximum error we may commit by using the table I have given. For thinner solutions and for lower temperatures the error would be less.

In the case of sugar solutions having 23 per cent. of sugar or less, I have given my reasons for thinking that their laws of expansion are similar to those of pure water. I may add that solutions of density equal to  $23^{\circ}\cdot 2$  Baumé and  $34^{\circ}\cdot 2$  Baumé show the same peculiarity in the dilatometer of greater expansion for equal spaces of time as the temperature increases.

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TRAITÉ THÉORIQUE ET PRATIQUE DE LA FABRICATION DU SUCRE, COMPRENANT LA CULTURE DES PLANTES SACCHARINES, L'EXTRACTION DU SUCRE BRUT, LE RAFFINAGE, &c.

PAR DR. E. J. MAUMENÉ.

*Continued from page 82.*

The influence of the different salts on sugar, with regard to crystallisation, was studied by Marschall, who, taking two parts of sugar for one of water, considered as favourable, those salts with which the water retained less than the two parts of sugar; and as unfavourable, those which produced a contrary effect. His results may be given as follows:—

*Favourable.*

Sulphate of Soda .. .. .	Chloride of Lime.
„ Magnesium .. ....	Aspartate of Potassium.

Nitrate of Soda	.. .. .	Acetate of Sodium.
„ Magnesium	.. ....	Butyrate.
„ Lime	.. .. .	Valerate „
Chloride of Magnesium	.. ....	Malate „

*Indifferent.*

Sulphate of Potassium	.. .. .	Oxalate of Sodium.
Chloride „	.. ....	Valerate of Potassium.
„ Sodium	.. .. .	Malate „
Nitrate of Potassium	.. .. .	Citrate of Sodium.
Carbonate of Sodium	.. .. .	Aspartate „
Oxalate of Potassium	.. ....	Caustic Lime.

*Unfavourable.*

Carbonate of Potash	.. .. .	Citrate of Potassium.
Acetate „	.. ....	Butyrate „

These last four salts are all of potash, and very difficult to obtain in crystals, the carbonate especially so.

The identity of sugar extracted from vegetables, such as the beetroot, &c., is, the Dr. considers, beyond doubt. It is very easy to be deceived on this point, and some very curious statements have been made with regard to it. Pure sugar is very difficult to obtain, as the crystals cannot be entirely freed from their mother liquor without very minute precautions. Cane syrup has little odour; the odour of beetroot syrup is, on the other hand, very strong and disagreeable, and so, every little of syrup retained by the crystals modifies their sweetness and odour, enough at least, to give rise to the suspicion that there is a difference between the two sugars. But it is very easy to show that this appearance, and others, are wrong. Let us examine the physical properties of the two sugars, the density, the rotatory power, the electric faculties, and the temperature of fusion. They are all exactly the same. Let us examine the chemical properties, and they also are all exactly the same. The same decomposition by heat, water, acids, and alkalies; the same solubility in the dissolvants; the same action on the salts; the same *sweetness*; the same mode of fermentation. In no case, and of this there is not the slightest doubt,

does the sugar extracted from vegetables, crystallised in oblique prisms and purified, differ in any of its characteristics. It is always a body of the formula  $C_{12} H_{11} O_{11}$  (taking this formula reduced to simple terms), with a sweetness always equal, and giving by fermentation equal quantities of alcohol, &c. It is always the same sugar, *normal sugar*. Just a word on the sweetening power of sugar. It is very difficult to define this power, and establish an exact comparison between the power of normal sugar and that of other sweetening bodies. In order to have a true and useful base we must take pure sugar; but this would rather confine us to the theoretical domain. In reality, sugar is always mixed with other bodies, of a particular taste, so as to modify this sweetness, which property changes much, in such conditions, the real sweetness of the sugar being, sometimes augmented, sometimes diminished by these other bodies, making a true and direct valuation of this power very nearly impossible.

The mode of formation of the sugar in vegetables is still unknown. What we do know may be stated in a few words, more or less just, on the totality of the facts, &c., on this head. Dutrône believed the mixture from the cane, in its first stage, to be an herbaceous acid; then it acquired a sweet taste, a lemon or amber colour, an odour like a renette apple; it looses little by little its colour, but the sweetness and balsamic odour becomes more developed, and the mucilage becomes sugar. Mirbel, speaking of sweet fruits, says "the fleshy pericarp absorbs oxygen and rejects carbonic acid; the sweet liquors develop in their tissues." Lamark et de Candolle consider that "at the time of maturation the sap penetrates into the fruit; . . . the oxygen due to the decomposition of the carbonic acid attacks the mucilage and changes it into a sweet matter." Couverchel first drew attention to the fact that fecule can be converted into gum, or an analogous matter, by simply subtracting the relative proportions of oxygen and hydrogen necessary to form a certain quantity of water; and he adds, "May we not presume that there is a second mutation—that of gum into sugar?" Petit considered sugar as being derived from tartaric acid (in the raisin). This acid, formed at the expense of

the cellulose, becomes malic acid under the influence of a reducing matter, and the malic acid becomes, in its turn, sugar. Unfortunately this is only a mere conjecture.

The question of the composition and crystallisation of sugar is fully treated of; but on this subject we have not made much further advances.

The nature of inverted sugar is not yet known. It is not a body defined by crystallisation, or by stable properties in certain limits, and well characterised; but a mixture always varying, from the moment in which inversion commences to the moment when it finishes, and in which the rotatory power, after having twice passed by  $0^\circ$  by *optical neutrality*, is arrested in the end by a last zero, that of *optical inactivity*. At this stage the primitive sugar exists no longer; in its place we have acids, the rough formulæ of which is similar to that of sugar, or only differs by some atoms of water. The proof of this statement is of the greatest importance for the fabrication, and not less so for science. Sugar inverted by water, aided or not by heat and acids, presents, as we have already seen, *incessant* variations of the rotatory power; and it is possible, as already shown, to seize, by means of the polariscope, the distinct periods in the phenomenon of this inversion.

Many efforts have been made to produce sugar synthetically, but as yet none have been successful. Petit has made some recent experiments relative to the production of sugar in the vegetable, which agree with his former experiments on the same subject, and confirm the opinion already given by him that, in a melon, for example, pulled before maturation, and communicating no longer with its leaves, there has been a transformation of inverted into cane sugar. In an interval of two days the polarimetric deviation passed from the left to the right. Dr. Maumonné, however, does not quite agree with the above views on the return of inverted sugar into normal sugar, even in vegetables. Everything goes to consider this return as impossible; but we cannot, at the same time, totally reject the opinions of distinguished chemists, and if the experiments of Petit are exact, we shall perhaps soon be in the way of a true knowledge of the relation between the sugars, and

what is not less noteworthy, of a method of producing normal sugar artificially.

Sugar is the matter, the fermentation of which produces alcohol and carbonic acid. Lavoisier found that the weight of sugar taken represents, very nearly exactly, the sum of the weights of the alcohol and carbonic acid produced. Thus 100 of sugar would give

51.11 Alcohol.

48.89 Carbonic Acid.

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100.00

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Now, to what is due this decomposition of the sugar, this alcoholic fermentation, because of itself, no matter how diverse the proportions of water added to it, and at the best temperature (from  $+ 25$  to  $+ 30^{\circ}$ ) sugar will not break up into alcohol and carbonic acid. We must, in order to obtain the fermentation, add to the mixture of sugar and water, two new matters; the one very different from sugar, owing to the nitrogen, of which it contains  $\frac{1}{2}$  of its weight, (albumine, or, in general, a *protéique* substance); the other, approaching nearer the nature of sugar, containing no nitrogen, and very analogous to starch or dextrine. These two bodies are found, in the most propitious state, among the elements of the juice of nearly all sugary vegetables. According to others, we must add to the sugary solution several germs of a globular microscopic being, the life of which would develop the fermentation of the sugar, and would grow into a multitude of similar beings destined to continue and finish this fermentation. It is these little beings which constitute the alcoholic ferment. In the first hypothesis the two bodies organise themselves to form globules; in the second, the globules are formed beforehand, and develop a new breed, which are nourished on the two bodies above. According to Thénard both are at first soluble, because we can filter through the finest paper a solution containing sugar, for example the juice of the beetroot, and, notwithstanding, it will soon commence to ferment even at the ordinary temperature. This is first known by a general cloudiness in the solution, and soon after a

disengagement of carbonic acid will take place, accompanied by an alcoholic odour. This cloudiness is caused by the production of the ferment, that is to say, of living organisms, produced by the two bodies with which they act, and this has been proved by both chemical and microscopical analysis. The globules are formed with an envelope of amylon similar, by its nature, to starch or sugar, and an interior liquid, *protéique*, analogous, at least, to albumine. The relative proportions of these two substances varies, and to this cause is due the different compositions given by different analysts. Notwithstanding the efforts of many chemists, the action of fermentation is still, in the words of Lavoisier, "one of the most striking and extraordinary of all those presented to us by chemistry." In fact, we may say, without hesitation, that although many theories have been propounded by men of the very highest authority, there is still very much wanting on the subject.

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### THE OFFAL AND ITS VALUE.

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It may be desirable to ascertain the value, if any, of the temptation which is proffered to planters to induce them to exchange sugar for rum. Therefore I beg to submit the following rough sketch to their revision, so that we may see how much is gained or lost by the transaction.

There is an estate in Demerara which produced 2000 hogsheads of sugar, and also 80,000 gallons of rum. The rum was made from sugar which bore two distinct names, the one molasses, and the other scummings; they were, together, esteemed "offal." According to the Demerara Prize Essay, each hogshead of sugar gave 117 gallons of molasses; consequently  $2000 \times 117 = 234,000$  gallons molasses were produced. Suppose it be convenient to bring these gallons into pounds; then  $234,000 \times 14 = 3,276,000$  lbs. of molasses. Now the polarisation of molasses has been taken at 66 per cent. for saccharose. Then  $3,276,000 \times \frac{66}{100} = 2,162,160$  lbs. of sugar in the molasses.

We now approach what may prove to be a piece of self-deception, where two sugars are used, yet only one is allowed to be credited

with the result. Hence the plausible colouring put on the facts. Of course molasses has a commercial value, but skimmings have no such value; not because it contains no sugar, but because that sugar has not acquired a marketable shape, although it has been long waiting for the opportunity. If we step into the boiling-house we may see the sugar boiling in the pans on "the copper wall." That concentrating sugar rises as froth. The escaping steam is enveloped in as many films of sugar as bubbles there. Impurities are borne upon this froth, and both impurity and concentrated steam-dilated sugar are together swept off the pan into a canal, which leads to the scum cistern, the contents of which are pumped up to the still-room to become rum. There is nothing in all this to deprive the skimmings of sugar, until they are put to ferment.

We need not enquire for the saccharic value of these skimmings. It has yet to be properly decided, about which there is the difficulty which grows out of the constantly varying treatment to which the sugar in the pans is submitted. The more wilfully the fire is urged, the more violent will be the boiling, and the more bountiful the crop of skimmings—sugar. I have seen an estimate so low as six gallons of *rough* skimmings supposed to be equal to one gallon of molasses. It will answer our present purpose sufficiently well, although far below its saccharic value.

Suppose we assume also that 129,000 gallons of skimmings were added to the molasses. Then  $129,000 = 21,500$  gallons of molasses. If we reduce these gallons to pounds, we have  $21,500 \times 14 = 301,000$  lbs., and 66 per cent. is sugar ( $\frac{221}{100} =$ ) 198,660 lbs. If we add together the sugar in the molasses = 2,162,160 lbs.

And     ,,     ,,     skimmings =     198,660     ,,

Then this offal contained 2,360,820 lbs. of sugar.

If these figures be correct, and the 80,000 gallons of rum, at 2s., produced £8,000, and a hogshead of sugar contains 1792 lbs., we have  $\frac{2360820}{1792} = 1317$  hogsheads. It is clear, now, that this sugar must have been sold to the rum-still at less than £6 per hogshead, to cover the attending expenses. We are led by the foregoing to infer that the annual loss to this extensive estate—



which is conducted with as much practical experience and perfect integrity as any estate in Demerara—cannot be much less than thirteen thousand pounds.

Suppose we allow every-day practice to correct, or corroborate our analysis, by assigning a definite value to each stage of the process in question. The canes being ripe and sound, we shall see how many tons of such canes can afford one ton of sugar. We simplify the operation by accepting every-day facts and figures. We assume the ton to be 2000 pounds; the extraction of juice 65 per cent. from the canes; the sugar in the cane 18 per cent. of the cane, and in the juice 20 per cent. of the juice, 11°·5 B. Then

$$2,000 \times \frac{1200}{1000} = 10,000 \text{ lbs. of cane-juice required,}$$

$$10,000 \times \frac{100}{1000} = 15,384 \text{ lbs. of sugar-cane required,}$$

And  $\frac{15384}{2000} = 7.692$  tons of sugar cane required, to produce one ton of sugar.

It is thus we may see that  $7\frac{3}{4}$  tons of sugar-canes afford all that is required for a ton of sugar. In practice there must be some waste of course, and the consumption is usually from 15 to 16 tons of canes per ton of sugar. The *difference* covers the offal and the waste. We may have ascertained the value of this “difference,” and decided its cost, sufficiently near for all practical purposes. The profit, I apprehend, is not quite so clear as the loss.

W. EATHORNE GILL.

*South Hill Park,*

*Hampstead, March, 1878.*

## AMERICAN CENTRAL SUGAR FACTORIES.

BY M. A. MONTEJO, C.E.

It may be laid down as an axiom, that the industrial interests of a country reach their highest development and greatest producing power, by a division of labour. Individual exertion, when concentrated on a single aim, is more energetic, and in time necessarily displays more skill, than when applied to a variety of objects.

Wheat, cotton and iron, for instance, in their different transformations, afford a variety of objects for the application of human

industry, which, however dissimilar, have a common point of contact,—the relative values of the raw material and of the manufactured article,—and these are regulated by the law of supply and demand. Butter and cheese, when the trade is carried on, on a large scale, as in Europe or the Northern States of this country, are the joint products of two distinct classes or associations of labour, one, which provides the milk, and the other, which transforms the raw material thus obtained into butter and cheese. In like manner, in all countries where forced labour has ceased to exist, and where the labouring classes evince a desire to improve their condition, sugar industry, far from attempting to produce its raw material, is content to buy it from the agriculturist, and to pay for it either in manufactured products or otherwise, according to local conditions. By this means, the production of the raw material is encouraged, because the manufacturer is enabled to exclusively attend to, and perfect all matters pertaining to his line, and to devise means to extend his operations. Hence it is that the production of sugar which, thirty years ago, did not exceed, in all the markets of the world, 800,000 tons, viz. : Cuba, 168,000 tons ; beet root producing countries, 55,000 tons ; and all other sources, 528,000 tons, has increased to upwards of 3,000,000 tons, Cuba coming in for 700,000 tons, various sources for 1,400,000 tons, and beet root countries for over 1,000,000 tons of this quantity. Therefore, the world's consumption of sugar has more than quadrupled in the last three decades :—Cuba's production increasing in about the same ratio, sundry sources in the ratio of about two and a-half for one, whilst the beetroot producing countries have attained the enormous figure of nineteen times their former production. The sugar manufacturer of Europe purchases and operates upon the beet root, which contains one-third less of saccharine matter than the sugar cane. But, beetroot was at first only the basis of a rotative system with grain lands, and encouraged by sugar manufacturers, continued to improve,—extending its acreage ; and it was by struggling against great difficulties, that this industry has obtained the wonderful development we have just enumerated,—showing the way, by its experience, and helping with its apparatus, the sugar cane industry.

If, in Louisiana, the sugar interest, under a system of forced labour, has been so prosperous in former times; if its crops were important enough to influence prices on all American markets; if with partial yields of three and four hogsheads to the acre, it reached a production of 200,000 tons; if, in fine, money was made with sugar at three to four cents a pound, how can it be doubted, that much greater results will be obtained when we shall have introduced a proper separation in the respective attributions of the planter and manufacturer? *That the American market offers a great future for the consumption of sugar it is a matter of fact*, as, with a population tending to grow in a tenfold ratio, the actual average consumption is about 700,000 tons, which shows an increase of 28 per cent. in the last decade, whilst its population has only increased 22·22.

In regard to the cost at which sugar can be made—the main question of all industries—if it now ranges between 4 and 6 cents a pound, by division of labour, separating the agricultural from the manufacturing interest, operating on a large scale, and taking advantage of the secondary productions, it is probable it will not go beyond 3½ cents a pound, with a value in the market of between 8 and 9,—this industry being protected by an ample protective tariff, and having in prospect the possible decrease of a great neighbouring crop, which is threatened by an endless political and social revolution.

*It is beyond a doubt that the United States could produce all the sugar needed for their consumption.* Several European states that imported colonial sugar for their use, now not only supply their requirement, but export and compete in the great English market. The productive power of nations increases itself more by the labour and the intelligence of its people than the gifts of nature, and on this ground the verdict pronounced in favour of "*Beetroot v. Sugar-cane*" is a matter of record."

The separation of the manufacturing and agricultural interests, and the consequent cheaper production of sugar, leads us to speak of "Central Sugar Factories," taking as examples institutions of the same kind adopted in Europe, and afterwards introduced in the

French West Indies, subject, of course, to such modifications as local circumstances may indicate.

The Louisiana planter may be said to have, as a general rule, a great deal of land, but to lack labourers. He has but little capital, and still less credit, to enable him to put this to good use. Besides, too many varieties of occupations claim his attention, and he has too many risks to bear. The consequence is that the result of his efforts is unimportant when not positively discouraging. According to Bouchereau the Louisiana crops of sugar show that 100lbs. of cane yield on an average 3lbs. of sugar and 2·15lbs. to 2·40lbs. of molasses; whilst from the beet 1lb. of sugar is obtained out of every 11·36lbs., equivalent to a yield of from 8 to 9 per cent.; and in central factories, where cane is operated upon with a pressure of 70lbs. to 75lbs. of juice to 100lbs. of cane, the yield ranges from 6 to 10 per cent., according to the density of the juice.

Central factories are the offspring of the beetroot sugar industry, and their adoption seems on the increase in all quarters. They have been introduced into most of the West India Islands, in Java, and in all countries where the progress of industry has originated the co-operative system and a division in labour. In Java, the Dutch Government grants a subsidy (reimbursable in twenty yearly instalments) to a company having for its object the establishment of a number of these factories, each to have a capacity to manufacture 1100 tons of cane into sugar per season. In the little West India islands of Sainte Lucie, Trinidad, and Santa Cruz, the Colonial Government offers a premium for the erection of similar factories. The islands of Martinique and Guadeloupe, entirely ruined by the abolition of slavery, have recovered their ancient prosperity during the last few years by the establishment of vast central factories, that of Arbussier, in Guadeloupe, with a capacity of 100,000 tons of cane, having cost 1,000,000 dols., and those of Martinique, fifteen in number, representing a capital of 4,300,000 dols., with a productive capacity of 68,000 hogsheads of sugar. Most of these factories belong to joint-stock companies, and, where managed with ability, have yielded dividends ranging from 27·33 to 48 per cent. The shares of one of these companies, named the "François," rose

from a par value of 100 dols. to 250 dols., as appears in an interesting report on these factories by Mr. H. Burton (see *The Sugar Cane*, 1st August, 1872, 1st February and 1st March, 1875). The yield and cost of the manufactured article obtained in the factories "La Renty," "François," and "Ponte Simon" may be cited as most remarkable. On an average 13 tons of cane made one of sugar, which is equivalent to 14,305lbs. of cane, or from six to six and one-third tons for one hogshead of 1102lbs. net, costing in cane 29.11 dols. or 4.50 dols. a ton, and 15.14 dols. for the manufacturing, or say a total of 38.48 dols. equal to  $3\frac{1}{2}$  cents per pound of the sugar already made. With so liberal a price paid for cane, which in most countries never costs more than 2 dols. or 3 dols per ton, no fear need be entertained for a short supply, and that, added to the cost of manufacturing,—amounting to about as much more,—leaves a sufficient margin to allow handsome profits. These results will be better illustrated in the following comparative statement, taking, as a standard, an average hogshead of 1100lbs.:—

Yield per 100lbs. of cane *to the planter*,—3lbs. of sugar, 2.40lbs. molasses; amount of cane for 1100lbs of sugar,  $16\frac{1}{3}$  tons, 32 dols.; cost of manufacturing, 35 dols; total, 67 dols. Gross proceeds, 1100lbs. at 6 cents, and 60 gallons at 50 cents, = 96 dols. less 67 dols.; net, 29 dols.

Yield per 100lbs. of cane *to the central factory*,—7lbs. sugar and 2lbs. molasses; amount of cane for 1100lbs. sugar, 7 tons at 4 dols., 28 dols.; cost of manufacturing, 15.40 dols.; total, 43.34 dols. Gross proceeds, 1100lbs. at 8 cents, and 12 gallons at 35 cents, = 92.20 dols. less 43.34 dols.; net, 48.86 dols. 86 cents.

It must be observed, that these results have frequently great changes—in keeping with the data taken for its basis. Thus, if the average yield reported by Bouchereau in Louisiana is correct—that is to say, if it takes  $16\frac{1}{3}$  tons of cane to make one hogshead of sugar, and assuming it to be the average production of one acre of land, the cost per acre for the plant cane is  $49\frac{1}{2}$  dols., and for the stubble  $14\frac{1}{2}$ , or on average cost of 32 dols. per acre, and which, deducted from the market value of  $16\frac{1}{3}$  tons, at 4 dols. each, or 65 dols. 20 cents, would leave the cultivator a profit of

33 dols. 20 cents, and to the planter who grinds his cane a gain of only 29 dols. Besides showing the difference in the production by the two systems, we must call attention to the large capital the planter has to employ for sugar house, machinery, etc., to the to the risky changes of the market, and above all, to the saving of time, which he can devote to improve his cultivation and increase his acreage. Comparing these results, we find that it costs the cultivator about one cent a pound of cane *laid by*, which might go up to one and a quarter, if it is added to the interest on the value of land,—taxes and additional expenses of ditching and fencing, being far from the reported *three* cents,—which would be a ruinous cost of 6 dols. 76 cents a ton, unless other charges and accidents, together with a bad management, may come, *as often happens*, to encumber the crop. The manufacture, however, with the additional expense of 50 cents for cutting and 50 cents for hauling a ton of cane, will cost the planter over 3 cents a pound, being a total of  $4\frac{1}{2}$  cents to make one pound of sugar; whilst at the Central Factory, according to the above statement, the cost of making a pound of sugar will not exceed  $3\frac{1}{2}$  cents, that is to say, 0·018 dols. for the cane and 0·014 for its manufacture.

In Louisiana, the growing of cane is essentially artificial; it is therefore extremely important that the plant should be subject to special care, in order to hasten its growth to an early maturity; and for this, among many other reasons, should there be an absolute separation of the labour producing the cane from that of manufacturing the sugar. The planter's task should be exclusively to increase and perfect his cultivation, in order to extract from his land all it can produce, and thus it will become possible to obtain 30 or 40 tons of cane per acre, when now only 10 to 20 tons are the average result. In estimating the value of cane, it should be borne in mind that the cost of growing it is uniform, whilst that of manufacturing it into sugar varies according to the quantity and density of the juice it yields, which chiefly depends on an early and efficacious cultivation; thus, a gallon of juice weighing 7° Beaumé, should yield one pound of sugar crystallized, at 8° it should yield 1·31 lbs.; at 9°, 1·59 lbs.; at 10°, 1·88 lbs.; at 10½, 2 lbs. of sugar. The value of cane, therefore, must be esti-

mated according to its maturity and the density of its juice, for aqueous cane will evidently entail an additional expenditure of fuel.

That the cane in Louisiana is not, as a general thing, properly ground, is proved by the quantity of juice remaining in the bagasse, and like *wild cane*, is slow to reach a state of decomposition. Obviously, this must be a source of loss in the yield, for 100 lbs. of cane at 8 per cent., containing nearly 15 lbs. of saccharine matter, actually gives at the rate of 50 per cent. of pressure only 5.70 gals. or about 7.41 lbs. of saccharine matter; at 60 per cent. the yield of sugar would be equal to 8.15 lbs., and at 70 per cent., 8.96 lbs.

Now, water is known to be the greatest extractor of sugar, especially at high temperature, on account of its powerful dissolving properties, since ten pounds of boiling water can dissolve nine times its weight of sugar, forming a very thick syrup; but no method has heretofore been adopted by which this principle can be applied practically, whether on account of the complicated machinery that would be needed, or the slowness of the process and the increased consumption of fuel that would be entailed. Thus, although all of the saccharine in the cane is known to be extracted by the process of dissolving it in water, yet it is not well established that such process would leave a margin for profits. With a view to solve this important problem, a new association, "The First Central Diffusion Sugar Manufacturing Company" lately put up a factory on "Louisa Plantation," to be conducted on the system of the divided labour above advocated, and of extracting the saccharine matter from the cane by the aid of water,—two very natural and correct principles. It is reported that said experiment has been a financial failure, but what seems to prove that it is not an industrial one, is, that the new owners intend to continue under the same principle.

(To be continued.)

We see among advertisements a word of caution which Mr. Gill has found necessary for those who adopt his process. It may be as difficult to discard old ideas as to adopt new ones.

## ILLEGAL COMMISSIONS IN THE WEST INDIES.

At a recent meeting of West India Planters and Merchants—Mr. Nevile Lubbock in the chair—and at which the following firms were represented, viz.: Messrs. Thomas Daniel & Co., The Colonial Co., Messrs. James Ewing & Co., Messrs. Bosanquet, Curtis, & Co., Messrs. Sandbach, Tinne, & Co., Messrs. J. Lamont & Co., Messrs. Cottam, Mortan, & Co., Messrs. Thomson, Hankey, & Co., Messrs. G. H. Loxdale & Co., Messrs. Hawthorn & Watson, Messrs. Claud Neilson & Sons, Messrs. Wilkinson & Gaviller, and Mr. Thomas Porter, it was resolved unanimously:—

“That the practice of giving commissions and allowances to estates’ employés, by engineering or other houses (either at home or in the colonies) supplying goods for the estates is pernicious, and should be discontinued. It is hoped, therefore, that the said firms will discontinue the practice entirely; and, on the other hand, that the employés will see that it is not consistent with their duty to their employers to accept such commissions and allowances.”

“That the above resolution be distributed, and brought to general notice in the colonies and at home.”

We have in previous numbers pointed out that all commissions received by employés belong, by law, to their employers. No attorney or other agent can legally retain any profit or emolument other than that which he receives from, or with the express sanction of, his principal. Every employer can recover from his employé any commission retained and not accounted for. The very essence of the law of agency is that all persons acting for others must duly account for all profits incident to the business. Amongst such profits must be included all commissions and discounts. It is not improbable that the Government will aid the civil remedy for improperly retained commissions by an Act of Parliament, making it penal either to give or accept an illegal commission or other bribe.



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THE UNITED STATES' TRADE WITH SOUTH AMERICA.

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It is gratifying, says the *New York Grocer*, to observe the steady development of our commercial relations with the South American countries. Already we are in a fair way of speedy and regular steam communication with Brazilian and Venezuelan ports. Elsewhere we publish an extract from the *New York Bulletin* giving some very interesting facts concerning the latter trade. We also learn from Senor José M. Samoyoa, Minister of the Interior of Guatemala, who is at present in this city on his way home from Europe, and who is the largest grower of coffee and sugar in that country, that his country has started on a new era of material prosperity within the past few years. Ten years ago, Guatemala hardly produced 1000 quintals of coffee; now it produces over 800,000, and at the present rate of planting and growth will, in less than 8 years, produce over a million. If trade facilities are enlarged, even this rate of increase will be enlarged. Sugar shows like power of increase; the capacity of production of this article in Guatemala being almost equal to the capacity of Cuba; but freight charges now act as a bar to the production of sugar outside of the more immediate trade. Within a comparatively late period, several planters, headed by Senor Samoyoa, have been experimenting in our markets, sending part of their coffee here and buying some supplies. The results led to the present visit of the Minister, and may be expressed, together with results of his visit, as most gratifying and stimulating to our business men. First, the net proceeds of their coffee have fully equalled and in many instances exceeded those of consignments to England; next, the cotton goods and machinery offered here are quite as cheap and much superior in quality and general character to those offered in the English market. In brief, it wants but one thing to turn three-fourths to seven-eighths of the trade of Guatemala, now controlled by England, to the United States, and that is the benefit due to their being 2000 miles nearer the United States than to England. When this advantage is utilized, not only the trade of Guatemala, but of Central America, will flow almost entirely into the United States, where can be found a market for all the

exports of those countries, and where they can find the imports they desire in better shape and quality, and at as low prices as elsewhere. It seems, therefore, that only freights and exchange stand in the way. Reliable merchants and bankers here have just tendered all the advances needed, which will satisfactorily settle the matter of exchange. The trouble is the matter of freights. It now costs more to ship coffee to New York, 1840 miles, than to London, 4300 miles. Two reasons are given for the ability of the English steamers to perform this greater service for a less rate. First, their subsidy of \$1,500,000 almost, if not fully, covers their working expenses; second, the heavy English trade give them, a full outward cargo. To these advantages over the New York steamers are added the incidental ones of established and regular channels of trade, opened and held by full and cheaper facilities of freight and exchange.

Trade with the United States is rapidly increasing in spite of these obstacles. Of late, commercial agents have been sent thither with full lines of samples from some of our leading mercantile and manufacturing firms. These agents are meeting with surprising success, appearing invariably to secure large orders. The superiority of our *bona fide* made cottons to the heavily-sized cottons of Manchester are commanding special and most favourable consideration. It is Minister Samayoa's opinion that our trade is bound to increase, now that mail and exchange facilities equal to those of Europe are assured to us, and his people are becoming cognizant of the superior character and cheapness of our goods, and that with a satisfactory settlement of the freight question and proper push of our exploring drummers, it is only a question of brief time when we shall change places with England as to the proportion of Guatemala trade controlled.

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QUEENSLAND.—January.—Crushing operations have been completed upon most of the plantations—an unprecedented event, considering the very large crop taken off. The season has, however, been of such a favourable nature that no stoppages have been rendered necessary, hence the early close of the crushing season.

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THE CULTURE OF EUCALYPTUS IN ALGERIA.

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We think our readers will agree with us that we are not misapplying our space by reproducing the following paper from the *Journal of the Society of Arts*.

Consul-General Playfair states that, during a journey made through Tunis, he has been impressed with the decadent condition of that country, and the causes of the exhaustion of the soil, which he attributes to the destruction of its forests, a process which has been going on ever since the Arab conquest, and more especially during the past hundred years. Since this visit, the Consul-General has given much consideration to the question of the *reboisement* of Algeria. The same causes which have been at work in Tunis have produced similar results, though in a less degree, in Algeria. In the latter country the destruction of the forests has been less complete, therefore the country has remained more fertile, but the climate is changing in an appreciable degree every year. At the period of the conquest the whole of the Sahel and a great part of the Metidja was covered with wood or scrub, which acted not only as a parasol to the earth, preventing the undue evaporation of its dampness, but as a means of attracting and condensing moisture in the atmosphere and causing it to descend in refreshing dews or rain. The first serious clearings were made in 1845, since which time the operation has been going on with ever-increasing rapidity. The diminution in the rainfall commenced in 1855. In the seventeen years prior to this date it was only on two occasions more than 1000 millimetres, and on eight occasions more than 800. In the twenty-one years which followed it has only twice reached 800 millimetres, and the present year is almost the worst of all, and something very like famine is imminent in Western Algeria.

The question, not only of restoring to the country the wood that it has lost, but of providing a supply of a constantly decreasing article, is the most important one that can engage the attention of the statesman or the colonist. If this had to be effected by planting such trees as oak, ash, pine, &c., all of which are indi-

genous to the country, it may well be imagined that a speculator would hesitate before engaging his capital in an enterprise which could hardly yield him a return in his lifetime; but with Australian trees, which grow as freely in Algeria as in their native country, he may expect to cover his expenses in ten or twelve years, and after twenty or twenty-five to obtain as great results as could be realised by oak forests of a century's growth. It is hardly more than fifteen years since the first eucalyptus trees were introduced into Algeria by M. Ramel, and very few indeed exist in the colony of a greater age than ten years; even now it can hardly be said that any attempt has been made to grow them on a great scale. There are many other Australian trees, suited to almost every condition of soil, found in Algeria, such as the beautiful acacias, or wattles, the grevillea, casuarmas, &c.; these are, no doubt, destined to play an important part in the *reboisement* of the country; but it is the eucalyptus alone which merits to be planted over extensive areas for the sake of its timber. There may be parts of Europe where this tree could be cultivated as well as in Algeria—though that is very doubtful; but hardly anywhere is the price of land sufficiently moderate to enable it to be grown with a certainty of profit. As a rule, wherever the orange tree flourishes, so does the eucalyptus. In Algeria it attains, in six or seven years, the same dimensions as the oak does in twenty, and, in its twentieth year, it may be expected to furnish such logs of timber, for ship-building or other purposes, as could not be furnished by an oak tree under 100 years old.

There are trees which, even in Europe, under certain circumstances grow with great rapidity, but the marvel is, that growing with the rapidity it does, the eucalyptus should produce at the same time hard and dense timber. A short time ago, wishing to send a eucalyptus tree of four or five years of age to England for experiment, it was found impossible, on account of its great length, to put it into a boat to convey it to the steamer. The boatman naturally decided on towing it alongside, but the moment he put it into the sea it sank to the bottom, and divers had to be employed to raise it. When properly seasoned its specific gravity becomes

less, and it then floats on water. To illustrate the quality of the timber, Consul-General Playfair instances the use of a vessel, the *Marie*, of 230 tons burden, which entered the port of Algiers with a cargo of timber in 1875. It was built in Melbourne in 1848, the hull being of blue gum (*Eucalyptus globulus*), and the interior fittings of red gum (*Eucalyptus resinifera*). At twenty-seven years of age it was still rated by the *Bureau Veritas* of the first class.

The first trees were planted in Algeria in 1862, and M. Trottoir gives certain pecuniary results he thinks obtainable from a hectare of land planted with eucalyptus. Thus a plantation of one hectare, which gives appreciable results in the third year, will yield in the tenth a minimum of 7000 frs., and in double the time it ought to produce four times the value. This estimate may be exaggerated, but even allowing a liberal margin for pardonable enthusiasm, the result cannot fail to be most remunerative. But to arrive at the best results with eucalyptus they must be planted in the best land, and for the first year at least be carefully cultivated. Thus treated they may be expected to realise immense returns. For instance, the average yield of a hectare planted in cereals in Algeria may be estimated at 250 francs, and, without taking any account of the years when such land must of necessity remain fallow, the total produce in twenty years may be stated at 500 francs. During those twenty years the cost of cultivation, the value of seed, the transport to market, &c., may be considered as equivalent to the cost of planting the same area in eucalyptus, tending the trees, and finally cutting them down. According to M. Trottoir's statistics the timber would then have a value of 26,000 francs, or, for the sake of being well within the mark, say 20,000 francs. If the cultivator has to remain a long time without any return for his money, surely the result is worth waiting for. The time during which these trees occupy the soil may be divided into two periods of ten years each, the first the period of growth, the second the period during which the ligneous products are condensed and consolidated. If, during the first period, the land is kept clear, and the same amount of culture is given to the trees as would be given to a vineyard, the cost, calculating 5 per

cent. interest on the sums successively expended, might amount, in round numbers, to 1000 francs. During the second period no care of any kind would be required. Under the circumstances, there is every reason to suppose that the trees would make as much progress in twenty years as they otherwise would in thirty. The cost of this extra care would amount to 1000 francs, and the profit to 13,000 francs. According to the tables of Cotta, a hectare of land produces 450 cubic metres of oak in 100 years, the value of which, at 105 francs the metre, amounted to 47,235 francs. The same quantity of eucalyptus wood might be produced in twenty years, and would realise 20,000 francs. This sum of money, placed at compound interest for 100 years, would realise the enormous sum of 816,800 francs.

The number of species of eucalyptus is great, but for the purpose of commerce, two or perhaps three species only should be cultivated. The first, the *Eucalyptus globulus*, or blue gum, is best suited to warm positions, deep fresh and moist soil. The second, *Eucalyptus resinifera*, or red gum, resists drought in a remarkable manner, and should be used in poorer or drier soil, or at greater altitudes than the other. It is hardly probable, however, that either of them will thrive well at a greater altitude than 200 or 300 metres above the level of the sea. The third species, which promises well, is the *Eucalyptus colosseus*, but hitherto our experience of it is limited, and we have not sufficient data on which to calculate its rate of growth.

There is another point of view from which the cultivation of eucalyptus must be regarded, namely, its action in improving the sanitary condition of unhealthy districts, and in dissipating miasmatic influences, which created such havoc amongst the colonists in the first years after the conquest. To place this subject as far as possible beyond doubt, an enquiry was instituted by the Society of Physical and Natural Sciences at Algiers, under the presidency of Dr. Bertherand, and reports were received from thirty localities. The spots best suited to the growth of the plant on a large scale, and the price of the land available for the purpose, is another subject worthy of consideration. To ensure the commercial success of the

scheme the trees must be planted on a line of railway, and as close as possible to a station. The soil ought to be rich and deep, and there ought to be sufficient water available for irrigating the trees during the first year, not unfrequently, but once when they are planted in the autumn, and twice or thrice during the course of the subsequent summer. They will grow in the driest soil, but their growth is infinitely more rapid when planted under the above conditions. The locality which fulfils these conditions best is the plain of the Metidja. Between Algiers and Blidah, on the line of rail, it is hardly possible to obtain land for less than 500 to 700 francs the hectare; some has recently been sold for 1000 francs. Further from the railway it may be had in some few places for 300 francs, but the cost of transport would neutralise the saving. In the plains of Chelif and the Mina there is an enormous quantity of land which may still be obtained for a merely nominal price. It would be an immense boon to the country if some of this were planted with eucalyptus, but the chances of profit to the cultivator would not be so certain. The soil is hardly inferior to that of the Metidja, but the hydrometrical conditions of its climate are very different. The range of hills stretching westward from Miliand cuts it off from the sea breezes, which always afford a certain quantity of moisture; rain is more scarce, and the farmer can hardly hope for more than one good year out of three. From Affreville, where it commences, to Oran, is a distance of about 300 kilometres. It is traversed by the most important river in Algeria, the Chelif, which rises in the Sahara and falls into the sea near Mortaganem. Other suitable spots are likewise mentioned by Consul-General Playfair. Along the line of railway from Algiers to Oran, considerable numbers of eucalyptus have been planted. Where this line passes through the Metidja the trees have grown most successfully, but in the Chelif they have failed in almost every case. It is true that they have not been tended in any way; they have merely been planted, and left to their fate. In and around villages in this plain they have thriven better, but never so well as in the Metidja, while, in the marshy plain of the Macta, conceded to M. Debrousse, which at first sight seems a typical position for them, they have not

done well at all. The reason of this is, that the land is not yet ready for them, it has lain in a state of marsh for centuries, the subsoil is saturated with salts, and the more the trees are watered after being planted, the sooner the capillary attraction brings the salt to the surface, and kills the trees or checks their growth.

On a careful consideration of the whole subject, the Consul-General is more convinced than ever that no culture in Algeria offers such prospects of success as the eucalyptus, if the cultivator can afford to remain for a considerable time without any return for his capital; that in the long run it will be more economical to purchase land for the purpose at 600 francs a hectare, than at 60 francs, but that to ensure success the experiment should be made close to a line of railway, and in a comparatively cool and salubrious position.

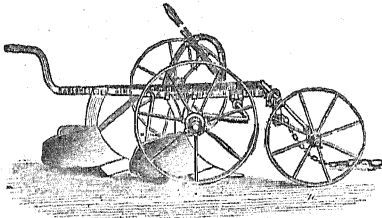
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### PLOUGHS SUITABLE FOR SUGAR CULTIVATION.

*Manufactured by Messrs. Ransomes, Sims & Head, Ipswich.*

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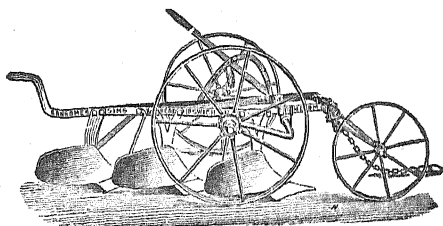
We have recently had our attention drawn to the new multiple ploughs invented and patented by Messrs. Ransomes, Sims & Head, of Ipswich, and which we think would be of great service in the large sugar plantations of the West Indies and other countries. These ploughs are made with 2, 3, or 4 furrows; the 3-furrow being, however, the one most generally in use. These ploughs which we have now the pleasure to illustrate were originally designed to



Patent 2-Furrow Plough, M.E.D.

meet the requirements of the large corn growing districts of Russia and Roumania, where it is necessary to plough a large quantity of land in a short space of time: they have, however, been so much





Patent 3-Furrow Plough, M.E.D.M.

appreciated and have given such satisfactory results that they are now largely used in other countries of Europe, as well as in South America, the Australian colonies, and at the Cape of Good Hope; and in these countries, economy of men and oxen being of such high importance, these ploughs have already found great favour.

The construction throughout is extremely simple, and the breasts or mould boards, can be made to suit any kind of soil or any system of culture. Simplicity in construction and great strength were absolute necessities in the design of these ploughs to insure their favour with the native farmers and labourers, who could not have been induced to try the more complicated pattern of English plough, and which on the other hand would not have been so suitable for the agricultural customs of their country. These ploughs are mounted on a triangular braced frame of a light section of iron, but so constructed as to ensure the most perfect rigidity; and on this frame the ploughing bodies are fixed.

The plough is carried on two large wheels, which by means of a lever can be depressed so as lift it some seven inches clear of the ground, and these wheels are so placed that when raised on them, in this way, an almost exact balance is obtained, and the plough is turned at the headland, or transported from place to place with great facility. This lever is used also to regulate the depth of the ploughing.

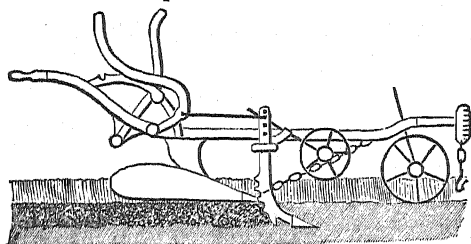
The breasts and shares of these ploughs are of steel, and all the other parts of wrought iron; each body ploughs a furrow 10 inches wide and from 2 to 7 inches deep, as required; and in the corn-growing districts of the east of Europe, where they are usually worked with oxen, it has been found that the three-furrow plough,

with eight oxen and two men, will accomplish the work of three single ploughs with which twelve oxen and six men would be required ; and they effect thus a most important economy to the farmers, who are in many cases entirely discarding their old implements in favour of these new ploughs. This proportionate economy also refers to horses, and one horse may be taken as equal to two bullocks.

The amount of land which these ploughs will cultivate depends very much upon the nature of the soil, the size and strength of the animals used, the depth of work required, and various other circumstances ; on an average, however, one of the three-furrow ploughs may be calculated to plough from about three and a half to seven acres, or from one to two hectares per day.

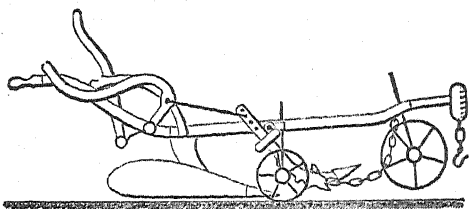
We take this opportunity of referring to Messrs. Ransome's new double plough and subsoiler combined, which has been specially designed for sugar cultivation in the island of Jamaica. This implement can be used either as a double furrow plough, the breasts being specially suited to the heavy soils on which the cane is usually grown ; or, as a combined plough and subsoiler, by simply removing the front breast and substituting a subsoiler.

The accompanying illustration shows the plough with subsoiler attached. This arrangement enables the ground to be stirred up to a depth of from 14 to 15 inches, and consequently the roots are able to penetrate into a much damper soil than when the ground is only ploughed 8 or 9 inches deep.



Patent Plough, T.C.D., and Subsoiler.—Subsoiler shown in working position.

In many districts also where the upper soil has become considerably impoverished by continued over-cropping or other cause, it is absolutely necessary to work down to a great depth so as to stir up



Patent Plough, T.C.D., and Subsoiler.—Subsoiler raised out of work. the subsoil. In such cases, this patented arrangement of plough and subsoiler is found to be very useful, as it prepares the ground for the sugar cane much better than the ordinary deep plough which turns all the subsoil to the top, whilst the new implement loosens the ground below the surface, thus enabling the roots of the cane to penetrate into virgin soil.

In conclusion, we have much pleasure in recommending Messrs. Ransomes' plough to the careful attention of our readers.

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### TREATMENT OF FROSTED CANES.

By MR. DAVID KER.

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*From the "Louisiana Sugar Bowl."*

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So much has been said and written, of late, regarding sugar-growing and sugar-making, without reaching such conclusions as would be a practical guide in the future, that one would be led to believe that there are no fixed rules, no established facts, no benefits from experience. A veteran in the business observes that, whilst much of truth and valuable information has been presented in recent writings, no one has put cause and effect in consequent connection. The very interesting paper on windrowing, from the pen of the Hon. Duncan F. Kenner, stops short of a conclusion deducible from the facts so clearly stated by him, which facts the writer of this and many others can fully substantiate. Another paper, from Gen. J. L. Brent, is full of matter vitally interesting to the sugar planter, yet concludes that there is nothing *certain* but the *uncertainty* of managers and sugar-makers.

Now, Mr. Editor, I am bold enough to say that there are fixed rules, not to be violated with impunity, in the cultivation of cane and the handling of cane juice, and especially in the manipulation of *frosted* cane and its juice. After twenty-five years *actual handling* of cane in the field and of cane-juice in the sugar-house, assisted by some knowledge of chemistry, I can say that I have never lost a cane windrowed for the mill, and have never failed to make good sugar from the last taken from windrow.

At my plantation on the Têche, in 1858, the cane having been on the night of the 7th of November,

*Frozen to Sticks of Solid Ice,*

I left standing in the field 150 acres of cane, which, fourteen days after the freeze, was absolutely *putrid*: but on the 19th of the following January, I made at the rate of fully two hogsheads per acre, fully fair sugar, from cane windrowed between 8th and 15th of November. This I did on open kettles, using bisulphite of lime, not losing one pound of windrowed cane.

In 1876, I boiled a large crop in parish of St. James, a large proportion of which was windrowed in November, and the last stalk, rolled in January, made prime sugar. This was accomplished with steam train and open pan, by fumes of sulphur process.

*In January made Good Sugar.*

In 1877, last year, I windrowed all but fifteen acres of my crop, after the freeze, and on the 21st of January (last month) I rolled the last of it, which was as sound as it was on the 29th of November, and made perfect sugar. That crop was boiled by sulphur process, in vacuo, and was grown on Deer Range Plantation, 50 miles below New Orleans.

*When to Windrow.*

I claim as a *fixed fact*, that the degree of cold which *completely annihilates* all vegetation in cane—which kills every bud and every eye—is *just* that degree of cold which leaves *no question* as to benefit from windrowing, and declares the absolute necessity for it, if there be more cane standing than can be saved within ten days; because all circulation of sap or juice, in an upward direc-

tion, having been arrested, the life blood of the cane is immediately and rapidly in course of being drawn by capillary attraction to the roots of the plant, and thence to the earth, and because, in its downward flow, each eye and each crack emits juice and admits air. We know that however imperfectly we may protect cane in windrow, by cutting it down, we arrest a direct and continuous loss through capillary attraction, and in some measure exclude the air and sun, which would have much free access to it if left standing in the field. We keep it nearer the cold ground and shade it, thereby keeping it at a more uniform temperature than would be possible when the whole stalk is exposed to such variations of cold and warmth as are manifest in every ten days of most favourable weather. I maintain that cane *perfectly* killed, will, in 99 years out of 100, make sugar 90 days after being windrowed, if ordinary care be taken in putting it down, and it be windrowed at any time before 48° Fahrenheit of heat will have reached the exposed stalk.

#### *Cause of Gummy Juice.*

Now then, why is it, these premises being considered, that the old stager *does* hesitate to windrow cane which has been only *partly* killed—as, for example, when the bud alone, or the bud and part of the eyes are killed? It is simply because the only question with him, then, is whether that cane has vitality enough left in its circulation to resist decay, or whether, conscious as he is that it cannot *improve*, he will submit to *some* loss from letting it stand or incur the greater expense of handling it *twice* to save a little more of it. He knows that from the moment the bud is killed his cane will not *improve*, and he knows, from that moment, any *living eyes* have an increased tendency to germinate, and that this tendency, this effort of nature to restore life to all its parts, will bring healthy sap and diseased sap in contact, increasing the production of that bugbear of sugar-makers—“*gum*.” (Oh! that word! How many short-comings have been excused in thy name!) Yes, if the planter is a practical and experienced sugar-maker, he knows that, after *partial* killing of the eyes, he experiences the presence, in his juice, of more gum and more dirt than he finds under any

other condition of cane—much more, after *partial* killing of his cane, if he let it stand and try to live, than he would have found if he had *finished* the *killing* of it and had put it in windrow. What will he do with it? I say windrow it if only for the sake of the sugar-maker and of the coal pile

*Windrowing before the Freeze.*

Now, you will say, what about windrowing *before* the freeze? I say *windrow*. If your juice weighs 7 or more degrees, and you have been injudicious enough to raise more cane than your machinery can work up before the 20th of December, windrow, by all means, a part of it, *before* the freeze reaches it and then—well, then, *windrow* the *rest* of it, or, as much as you can, *after* the freeze, before the mercury will have shown (say) 50° of heat. The old planter will be satisfied with juice weighing 9° and shows that he has lived *too* long, if he hesitates to *save* all that weighs 8½.

Much, very much, more might be said on the subject of windrowing, to save cane for the mill, but your patience would be too sorely tried if I presumed to add much to this hurriedly written communication. I will only add that I can not divest my mind of the belief that much of the disaster which followed windrow, last year, was owing to a panicky haste in disposing of the very crooked cane, which required infinitely more pains than ever before, owing to its extreme size, crookedness, and greenness. But, Mr. Editor, a far greater share of blame for that disaster is due to the fact that very

*Few Sugar-makers know how*

to manipulate *frosted* juice. A great many use sulphurous acid gas and lime, without knowing why they use them, and do not seem to know that the whole treatment of frosted cane juice, from the time it leaves the mill until it is put into the hogshead, should be totally different from the treatment of sound juice. The sugar-maker, in his very first touch of the juice, *may finish* the *destruction* of the saccharine, which the frost had only begun, unless he knows the difference between vegetable and mineral acids, and the exact effect of different alkalis upon either or both. He may know

that, and yet fail to make sugar if he does not know when and how to *boil* his frosted juice. He has not seen disasters enough to enable him to say he knows how to encounter them. Every old sugar-maker has seen in blown-down, frosted green cane of "new ground" just that condition of things of which *everybody* saw so much last year, but the world was none the wiser, for the sugar-maker, when he came to "that little patch of new-ground cane," said, "I pass." He *did* pass, after making some *toughy*, to riper cane, and the *planter* was *euchred*. Cane-juice must be *terribly corrupt* before it reaches that point at which the practical sugar-maker fails to find *some* sugar in it. And now comes the polariscope, to tell us to a certainty just what we can and cannot do.

(To be continued.)

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### Correspondence.

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TO THE EDITOR OF THE SUGAR CANE.

Sir,

No one can fail to be interested in the article on optically inactive sugar by Messrs. W. E. Halse and J. Steiner that appears in your October number (1877). Mr. Halse is so well known, both at home and in the colonies, as an authority on all matters connected with sugar, that I, in common with many others, have often regretted that his name so seldom appears in your pages. I have great pleasure in acknowledging how much information I have obtained from reading the various articles and letters that have appeared from time to time in *The Sugar Cane*, but there are still several points on which I should like to have the opinion of your correspondents. In Mr. H. C. Humphrey's article "On the Methods for the Valuation of Raw Sugar," (July, 1876, p. 369,) he writes:—"Now, glucose has a left handed rotation of about one-third the effect of cane sugar. If, therefore, there is present three per cent. of glucose, there will be one per cent. less cane sugar shown by the polariscope than there actually is. The three per cent. of glucose has neutralized one per cent. of cane sugar. This is the theoretical result, but I must con-

fess that, in the examination of sugar by inversion, I have failed, sometimes, to find the error so great, which fact has been explained by considering the glucose to be partially present in an *optically inactive condition*." In the same number (page 377), Mr. R. F. Smith writes: "Mr. Humphrey mentions cases in which glucose is present in an *optically inactive condition*, but, as far as I know, this never occurs in cane sugars, but is so, abundantly, in date sugar and also the sugar from many fruits." Now, it would be interesting to know what sort of sugar was in the ship from which Messrs. Halse and Steiner obtained their sample. Then, again, Messrs. Halse and Steiner write (October, 1877, p. 539): "Chemists who have had to deal with cane sugar are often led to believe, from the result of their analyses, that the fruit sugar present is without influence on polarised light." Is this view generally accepted by your correspondents, or are they in the habit of making an allowance for the presence of un-crystallizable sugar? Has the Marguerite process ever been tried on beet molasses in England? I have, from time to time, seen analyses of the molasses from the French beet refineries, and the "diffusion process" in your journal, but, as far as my memory serves me, none of the chemists engaged in refineries at home have ever favoured your readers with analyses of treacle. The experiments conducted by Messrs. Russell and Stewart, at Leonora, have caused planters to note carefully what percentage of juice they are getting from their canes, and many have started double crushing. Now, having obtained a larger yield in cane juice, are they careful to examine from time to time the molasses that are sent to the still, and see that, after allowing a co-efficient for glucose and ash\*, they are getting out as much sugar as they ought to do? I am inclined to think that a series of analyses of the offal of the home refiners and the molasses from the colonial boiling houses would be of interest to many of your readers. We have many of us read the numerous

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\* I am very well aware of the difference of opinion that exists as to the reason of the formation of molasses. The matter has been placed before your readers from time to time in your pages, and they must decide for themselves if uncrystallizable sugar has any influence on the "*rendiment*," and if 3.6 is the proper co-efficient to adopt for salts.



articles that have appeared from Mr. W. E. Gill. I have never had an opportunity of seeing Mr. Gill's process at work, but I hope it is only a pleasure deferred. At the same time, are we not promised a little too much? Mr. Gill writes (*Sugar Cane*, March, 1876, page 153):—"Pardon the egoism, but I use no lime in my clarification, and get no offal, but a larger sugar product instead." Now I believe that, theoretically, ripe canes should contain no uncrystallizable sugar, but have any of your readers ever found a sample of cane juice fresh from the rollers to be free from it, and does not all cane juice contain a certain proportion of salts? I take it that galvanism will not free the juice from these, so that practically Mr. Gill cannot avoid making molasses. At the same time, I think planters should give it a trial; it certainly possesses one great feature to be admired, namely, it introduces no soluble salts, which remain as molasses producers. Day after day, and year after year, we read that when as much attention is paid to the chemistry of the sugar cane as has been paid to the chemistry of the beet, "cane sugar will be better able to hold its own;" and plenty of men will say—"Yes, we ought to have chemists." But—they won't pay for them. They can realize the advantage of laying out £500 on their buildings, or in the field, but they would consider for a long time before spending £50 on chemical apparatus, and would be perfectly horrified at the idea of paying for a resident chemist. If you suggest the latter they say—"What is the good of paying a fellow to tell me what is in the cane juice; I know I get all the sugar out of it that is possible." In some few cases planters take up chemistry themselves, but many of them find it tedious and irksome, and say—"My time can be much better employed on other things." Even in works where a laboratory is recognised you find that some out of the way corner has to be sacrificed to it. Messrs. Boivin and Loiseau's "suerate of hydrocarbonate of lime process," which has been introduced into Australia by Mr. Robert Tooth,—into Demerara by Mr. Quintin Hogg, and into Manilla by the "Manilla Yengarie Company," necessitates a new order of things, and in each of these three places laboratories are established, and every facility is afforded to conduct

the manufacture of sugar on a scientific basis. At Messrs. Tooth and Cran's refinery at Yengarie the process has been in operation for some years, and 40,000 gallons of juice are passed through the works in the 24 hours. By Mr. Hogg's request, I have been spending some weeks at Yengarie, and I gladly take this opportunity of acknowledging the hospitality and kindness that has been shown to me during my stay, and the invaluable information and assistance given to me, both in the works and in the laboratory, by Mr. John Cran, who, with ability and powers of endurance possessed by few, has identified himself with the success of the undertaking.

Your obedient Servant,

CHARLES WILLIAMS.

Yengarie, Queensland, Australia, Dec. 28th, 1877.

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## MONTHLY LIST OF PATENTS.

Communicated by GEORGE DAVIES, C.E., Patent Agent, 4, St. Ann's Square, Manchester.

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### ENGLISH.

#### APPLICATION.

925. EDWARD CHARLES ROETTGER, of 36, Finsbury Park-road, Middlesex, Civil Engineer. *Improvements in filtering presses, for expressing the more liquid parts from the more solid parts of semi-liquid matters.*

#### ABRIDGEMENTS.

2839. JOHN HENRY JOHNSON, of London. *Improvements in treating saccharine matter, and in the apparatus employed therein.* (A communication from Albert Fesca, of Berlin.) This invention relates to the clarifying of sugar after it has been drained in a centrifugal machine, and before it is removed therefrom, and it consists in a mode of, and an apparatus for, effecting this object by the dispersion of clarifying liquor or liquid in the condition of spray over the interior surface of the tubular mass of sugar contained in the drum of the machine, the liquor forming an annular film, which by the motion of the machine is caused to permeate the mass of sugar and expel any impurities which may be contained therein. The principal feature of the invention consists in the combination with a centrifugal machine of a vessel or chamber (which the inventor designates a "centrifugal liquor disperser"), into which the clarifying liquor is introduced, and from which it

is expelled on to the inner surface of the mass of drained sugar, as before mentioned.

2924. HUGH WILLIAM WALKER, Sugar Refiner, and THOMAS LAW PATTERSON, Analytical Chemist, both of Greenock, Scotland. *Improvements in apparatus for purifying or refining sugar.* This invention relates to the purifying or refining of sugar, by treating it with steam combined with air, when it is in the centrifugal machine. The sugar to be operated upon is first, if necessary, reduced by crushing to a uniform condition, and it is then mixed with syrup obtained from sugar previously treated in the apparatus described below, or with low syrup or molasses obtained from raw or more or less refined sugars, such as "jelly" or "bastards," or the coarse products of the refinery, or with syrups obtained by concentrating "char water" or other sweet water, the mixture being made in such proportions as to form a thick magma, resembling "*masse cuite*." The magma of sugar and syrup may be made in any suitable apparatus. The improvements in the centrifugal machine are applicable to machines like any kind in use as regards the parts not altered by the improvements, whether they be under driven or over driven. In the case of an under driven machine, a sheet metal cover is fitted to the top of the basket, and after a charge of sugar magma has been filled in is secured by snibs, the joint at the periphery being made tight with a rubber ring. A bell-like or other suitably shaped mouthpiece is fixed in the centre of the cover, and a nozzle fixed to a steam pipe is placed so as to direct a jet of steam by the tube into the basket, such steam jet causing a quantity of air to enter the tube with it. At a short distance under the cover a sheet metal disc is fixed, to receive any drops of water due to condensation, such drops being by the centrifugal action thrown from the edge of the disc into an annular pocket, formed by a conical or curved sheet metal ring attached to the inside of the cover, and having its thinner edge below the disc. The water thrown into the annular pocket escapes by holes to the outside of the cover, and thus drops are prevented from reaching the sugar. In conducting operations with this improved apparatus, the sugar magma being placed in the centrifugal machine in the usual way, the machine is set in motion, and when the syrup is considered to be completely discharged, or nearly so, the steam jet is turned on, and the water injection also, if thought desirable. The supply of steam is kept up until the syrup running from the machine is colourless, or as nearly so as is wished. If the sugar is desired to be soft, water may be injected with the steam towards the end of the operation, and will make the sugar more easily removable. The machine is finally run a few minutes after shutting off the steam, before discharging the sugar.

#### AUSTRIAN.

108. J. AND H. SEBEK, of Prague. *A bayonet-locking-ring for the spy-tubes of polarisation saccharimeters.* (Public.)

132. WULLSCHLEGER-HOZ, of Vienna. *Evaporators and filters for purifying beet juice.*

#### BELGIAN.

43760. R. FRÉMAUX. *Improvements in centrifugal turbines for clarifying sugar.*

43892. LECOINTE AND VILLETTE. *A press for beet pulp and other semi-fluid substances.*

43926. R. RIEDEL AND R. BERGREEN. *Hot maceration for extracting beet-juice.*

44118. A. LALOUETTE. *An hydraulic press for extracting beet juice.*

44161. A. DORZÉE and MALLIAR-LAMBLLOT, of Bousson. *An apparatus for evaporating and vacuum boilers.*

44258. N. RILLIEUX. *A vacuum evaporator with multiple action, applicable to sugar juice and other liquids.*

44293. E. DELARUE & Co. *Saccharification of amylaceous substances.*

#### CANADIAN.

8145. ELEAN WILLIS, of Colton, New York. *Improvements in sap spouts*

#### FRENCH.

119210. KRAUSCHITZ. *Purifying sugar-juice by combined evaporators and filters.*

119276. GALLOIS. *A beet root elevator.*

119460. LEBÉE. *Improvements in the manufacture of beet-sugar and in machinery employed therefor.*

113520. LIEBERMANN. *Improvements in the manufacture of sugar.*

80422. CHAMPONNOIS. *Extracting and purifying beet juice.*

115563. KORTING. *Claying sugar in turbines.*

116948. FILTER. *Artificial production of animal black.*

107341. MANUEL AND SOCIN. *A continuous press for sugar works.*

119724. FLETCHER. *A cane crusher.*

119750. DIVIS. *Reviving animal black.*

119931. REYNAUD, of Tournus. *A system of filtering for separating and washing the residue of the turbid liquids of sugar works and distilleries.*

120053. BONNET. *A plough for extracting beetroot.*

120173. VIARD, of Nantes. *Sugar tablets breaking in regular pieces.*

120227. ROUGIER. *A continuous turbine for sugar works.*

120250. SELWIG, MEHRLE, and RIEDEL. *A compound valve for the distribution of juice in diffusion batteries of sugar works and leviators in general.*

120262. LECLERCQ. *Washing and decolouring molasses and syrups by expulsion.*

#### CERTIFICATES OF ADDITION.

113520. LIEBERMANN. *Manufacturing sugar.*

117818. HOPPE. *Extracting beet juice.*  
 115434. DE MOREL. *Extracting sugar from cane liquor.*  
 87091. SIMON. *Tubular action on sugar juice.*  
 114708. ROUSSELOT. *A mill for crushing sugar cane.*  
 99923. LALANDE, JUN. *A best press.*  
 115257. FRÉMAUX. *A centrifugal apparatus for clarifying sugar.*  
 118372. MEHAY. *Osmotic clarification of syrup, &c.*

## GERMAN.

6140. E. A. BRYDGES. *Purifying sacchariferous liquids (syrops) by means of sulphate of alumina.*

4546. A. MARTIKKE, of Schönsbeck, on the Elbe. *Cane press sieves for sugar works, &c.*

## AMERICAN.

199864. EDWARD K. RICHARDS, of Cambridge, Massachusetts. *Improvement in processes for separating saccharine matters from air.* This invention relates to apparatus for saving floating or other particles of sugar carried in the air issuing from sugar-drying machinery, and consists in a process of extracting the saccharine matters from the air issuing from the drying apparatus as follows:—Inside a cylinder or other case is arranged a series of water-spreading shelves, rising above wall shelves, the shelves being so made as to permit water on one to fall upon the other, and, in so doing, to cross passages between the shelves, through which the air blown from the dryer travels, such air issuing from the case into a chimney. Water is introduced into the case through a pipe at the top, having at its discharge end a cone-shaped water-distributor, which, co-operating with the first of the water-spreading shelves, causes the water to be thrown out radially as a film or sheet, and the descending water, meeting the ascending air, deprives it of all its saccharine matters.

## SUGAR STATISTICS—GREAT BRITAIN.

TO MARCH 16TH, 1878 AND 1877. IN THOUSANDS OF TONS, TO  
THE NEAREST THOUSAND.

	STOCKS.		IMPORTS.		DELIVERIES.	
	1878.	1877.	1878.	1877.	1878.	1877.
London . . . .	82	59	53	54	66	47
Liverpool ..	31	29	41	53	41	40
Bristol . . . .	3	4	10	12	10	10
Clyde . . . . .	52	24	62	48	49	42
Total ..	168	116	166	167	166	139
	Increase..	52	Decrease..	1	Increase..	27

STOCKS OF SUGAR IN THE CHIEF MARKETS OF THE WORLD ON THE  
1ST FEBRUARY FOR THREE YEARS, IN THOUSANDS OF  
TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
169	170	32	99	3	473	344	471

CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING  
1ST FEBRUARY, IN THOUSANDS OF TONS.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
874	256	30	276	162	1598	1597	1611

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE,  
FOR THE ENSUING SEASON, COMPARED WITH THAT OF THE THREE  
PREVIOUS SEASONS.

(From *Licht's Monthly Circular*.)

	1877-78.	1876-77.	1875-76.	1874-75.
	Tons.	Tons.	Tons.	Tons.
France .....	370,000 ..	243,295 ..	462,259 ..	450,877
Germany (Zollverein)	370,000 ..	291,204 ..	346,646 ..	250,708
Austro-Hungary ....	245,000 ..	205,267 ..	180,138 ..	140,192
Russia and Poland ..	220,000 ..	250,000 ..	245,000 ..	222,500
Belgium .....	65,000 ..	44,467 ..	79,796 ..	71,079
Holland and other Countries.....	25,000 ..	25,000 ..	30,000 ..	30,000
Total.....	<u>1,295,000</u>	<u>1,059,233</u>	<u>1,343,839</u>	<u>1,165,356</u>

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STATE AND PROSPECTS OF THE SUGAR MARKET.

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The Sugar Market during the past month has been healthy in tone, and an advance of about 1s. 3d. in the price of Paris loaves, together with reduced stocks of refined, has lead to an advance on refiners products, and has strengthened the market for raw sugar, which closes slightly dearer. Beet is quoted about 9d. higher than a month ago.

The relative value of cane and beetroot sugar is more nearly on a par now than for some time past, when the position has been to the advantage of cane sugar.

The statistics have also favoured a firmer tone in the market, the increase in consumption over 1876 at this time being 26,500, against 17,000 tons at the end of February, whilst the stocks which on 16th February showed an excess over those at the same time in 1876 of 69,452 tons, showed an excess only of about 58,000 tons on the 23rd March, as compared with those of last year at the same period, and it is improbable that supplies will equal those of last year at this time, when high prices enticed shipment from every quarter in which sugar could be gathered.

The West India crop, especially the Cuba crop, seems likely to be retarded in delivery here, and the anticipation of this has its share in strengthening prices.

It is said that the production of refined, which has recently been considerably lessened, has not yet overtaken wants; if this be so there is the ground for hoping to see prices continue as they are.

Present quotations of the standard qualities are as under:—  
Porto-Rico fair to good refining, 21s. to 21s. 6d., against 21s. to 21s. 6d.; good to fine grocery, 22s. 6d. to 25s., against 22s. 6d. to 25s.; Martinique crystals, 27s. to 27s. 6d., against 27s. to 27s. 6d.; No. 12 Havana, 23s. 6d. to 24s., against 23s. to 23s. 6d.; fair to good refining Cuba Muscovados, 21s. 6d. to 22s. 6d., against 21s. to 21s. 6d.; middling to good brown Bahia, 19s. 6d. to 20s.; against 19s. 6d. to 20s.; good to fine Pernambuco, 20s. to 20s. 6d., against 20s. to 20s. 6d.; Paris loaves 29s. 3d. to 30s., against 28s. to 28s. 9d.

# THE SUGAR CANE.


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 The writers alone are responsible for their statements.

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## HOLLAND AND THE CONVENTION.

The new Dutch Ministry, having now settled down to its work, has made up its mind as to the Sugar Convention. The Finance Minister has made a statement to the Chambers, in which he says: Firstly, that in the present state of the finances it would be extremely dangerous to make any considerable reduction in the sugar duty; secondly, that it has been proved, from the discussion of the Convention of 1875 in the Chamber, that there exist important obstacles to the introduction of Excise supervision in the Netherlands; and, thirdly, that there are serious defects in the system of refining in bond, "which is, in fact, only an ill-conceived method of levying the duty on the finished product, giving insufficient guarantees against fraud." The Minister furthermore states that, as he knows of no other basis on which an international Convention could be established, he has considered it his duty to notify these considerations to the interested Powers. As to the question of remedying the known defects in the existing system, by a revision of the law without a Convention, he admits that those defects, though perhaps exaggerated, cannot be denied. How to remedy them with due consideration for the interests of industry, commerce and the Treasury is, he considers, a very complicated question. It has become the subject of serious consideration to the Minister of Finance. Alterations in the classification and a reduction of duty will be matters for examination, but the Minister is by no means convinced that the results—especially of the latter



measure—would answer the expectations, or that the Treasury would be recouped by an increase in consumption. However that might be, the Minister concludes, neither the state of the finances, nor the very uncertain circumstances in which sugar as an article of commerce has been recently placed, would permit of any immediate decision as to when or how the existing law should be ameliorated.

This extraordinary announcement, so completely at variance with all the opinions expressed by the Government of the Netherlands during the negotiations of the last three years, has, we understand, been followed by a memorandum addressed to the Governments of this country, France, and Belgium. The Dutch Government state that they examined the draft Convention of 1877, and that it appeared to them to leave doubts and to present inequalities which it was of importance to clear up and to remove before submitting a new Convention to the approbation of the legislative powers. They, therefore, made a proposition, in June last, with the object of fixing the wording of Art. III. in the sense established by the Convention of 1875, of placing the interested Powers on a footing of equality by modifying details in the Belgian system and by extending to all the faculty to apply that system under the same conditions if circumstances should permit. Difficulties were raised against this proposition, and were not resolved at the time when the present Government entered upon its duties. The memorandum then goes on to state the results of their examination of the question “in regard both to the interests of the Treasury and to those of industry and commerce.” These are, of course, a repetition of the statement to the Chambers. They may be summarized as follows:—

1. Supervision of refineries (*Exercice*) was opposed in the Second Chamber of the Netherlands in 1875, and therefore there is little hope that it would now be accepted.

2. The system described in the last Conferences under the name of refining in bond (*Entrepôt*) amounts to a mitigated supervision, which, according to competent authority and under existing circumstances, presents insufficient guarantees against fraud, except with a more or less considerable reduction of the duty.

3. As it is impossible to reduce the duty at the present time, the Cabinet of the Hague regrets to be unable to find, for the moment, any basis for the conclusion of an international arrangement.

The replies to these purely imaginary difficulties are very simple and, we think, very conclusive:—

1. According to the published reports of the debate in the Second Chamber, the arguments against the treaty which had most weight were not based on objections to supervision, but on a supposed impediment which the treaty would present to an abolition of the duty in Holland. The best proof that the Chamber did not object to the system of supervision on which the Convention of 1875 was based, is to be found in the fact that it subsequently resolved, by a large majority, "that the Chamber, having heard the statement of the Minister, desires that communications should be made to the three Powers who signed the treaty of August, 1875, in order to take that treaty up again, provided that Holland should have complete liberty to abolish the duty." This is the last utterance of the Chamber on the subject: the Dutch Government re-opened negotiations on account of this resolution, and have for the same reason strongly advocated supervision ever since. It must, therefore, be by an extraordinary process of reasoning that it can now be argued, that the Convention which the Chamber resolved on taking up again should now be abandoned in the fear that the Chamber would reject it.

2. That form of supervision which the present Dutch Government calls "the system described in the last Conferences as refining in bond," and which they stigmatize as "a mitigated supervision which, according to competent authority and under existing circumstances, presents insufficient guarantees against fraud," was, in fact, formulated by Holland, proposed by Holland, and defended by Holland in a most obstinate and persevering manner against all the captious and evasive attacks of France,—a defence which prolonged the Conferences for five weeks, caused one of the delegates to return to the Hague for further instructions, and brought him back with stronger instructions than ever to insist on the Dutch system of refining in bond or nothing. And now, because

this Dutch system has been accepted at the Conference, we are told by Holland herself that the Convention must be abandoned, together with all hope of concluding an international arrangement, because her own system is an insufficient guarantee against fraud. Here again, then, the reasoning may fairly be called extraordinary. "Competent authority" is invoked by Holland in condemnation of her own system. But where can Holland find within her borders a more competent authority on questions relating to the collection of customs or excise duties than her own "provincial inspector of direct taxes, customs, and excise duties?" Yet it was he who drew up this system of refining in bond and who has taken part in defending it at the Conferences. How can it be said, then, that competent authority condemns it?

3. Lastly, the Dutch Government says that it finds it impossible to forego a part of its revenues, and that, therefore, as it cannot reduce the duty, it cannot accept the Convention. To this the Minister of Finance adds, in his communication to the Chambers, that although a reform in the present system is under consideration, he can assure the country that in the present uncertain position of the sugar industry he will not say when or how it is to be altered, and that the existing régime will certainly last another year. Now, it will be recollected that we gave, in *The Sugar Cane* for March, 1876, a summary of a letter addressed by Mr. Toe Water, Inspector of Taxes, Customs, and Excise Duties, and Delegate of Holland at the Conferences, to a Rotterdam newspaper, in which he states most distinctly that under the present system the Treasury loses 1,800,000 florins per annum in bounties to the refiners. Such a statement, made on authority which cannot be mistaken, naturally leads us to enquire how it is that with a Treasury so little able, as declared in the memorandum of the Government, to afford any loss of revenue, Holland should now withdraw from a Convention which, according to their highest fiscal authority, "will remove both Dutch and French protection, and put a stop to a system by which money is sacrificed in order to give sugar cheaper to the rest of the world."

It appears, therefore, that the Dutch Government, after promoting negotiations for the last six years with the view of procur-

ing a Convention with this country, France, and Belgium, for the purpose of abolishing bounties on the export of sugar, now desires to retire from those negotiations on the grounds : first, that the system which the Chamber, by a formal resolution, desired to be made the basis of the treaty, would never be accepted by that assembly ; secondly, that a modified system, proposed, formulated, defended and insisted upon by Holland, is so bad that it vitiates the whole arrangement ; and, thirdly, that the wants of the Treasury are so urgent that it is absolutely necessary immediately to desist from agreeing to a Convention which would have added 1,800,000 florins to its revenue.

The version given by this memorandum of the Dutch Government of the latest incident in the negotiations will as little bear close examination as the reasons given for withdrawing from them. It states that Holland made proposals in the month of June which were not accepted by the other Powers. But it fails to explain that the proposals formulated by the Dutch Government after the draft Convention had been referred to them for their approval, were made not in June but in April, and were agreed to by the other Powers. Those proposals were made and dealt with as a full statement of the criticisms of the Dutch Government on the draft Convention, and of their suggestions for its modification. It was modified accordingly, and it was fully understood at the time that the Dutch Government were satisfied. Nevertheless, they made a fresh proposal, in June, that any country which should reduce its duty to the amount agreed upon by Belgium should be at liberty to adopt the Belgian system. Two very natural objections were raised to this suggestion ; first, that it had never been proposed at the Conferences, where alone it could have been fully and properly discussed ; and, secondly, that it had not been included in the proposals already formulated by the Dutch Government since the close of the Conferences, and on which an agreement had already been come to. Thus, it will be seen, the impediment referred to in the memorandum of the Dutch Government originated solely with themselves.

We need not animadvert further on the unreasonable character of the conduct of the Dutch Government. It is, we think,

sufficiently evident from the explanations we have now given. It is difficult to know how to deal with this kind of treatment. 'Playing fast and loose' is not a kind of game at which our Foreign Office is likely to be anxious to waste much time just now. Still, it has seriously undertaken to get the sugar bounties done away with and fair play restored for British producers. It is, therefore, we believe, incumbent on our Government to point out in tolerably distinct language the very untenable position which the Dutch Government have taken up.

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### H A V A N A .

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*Report by Consul-General Cowper upon the Trade, Commerce, Agriculture, &c., of the Island of Cuba, to the end of the Crop 1876-77.\**

The year 1876 opened under very depressing influences; not only was Cuba suffering with the rest of the world from the general stagnation of trade, but circumstances, peculiar to itself, tended to darken its prospects to an almost hopeless extent; the civil war, which had lasted nine years, with its ruinous expenditure, continued with scarcely a perceptible hope of its suppression; taxation had been raised to an insupportable point; gold was at a premium of 138 per cent., and business was carried on with a discredited paper currency, practically inconvertible; the expense of living had reached a limit which enforced a hitherto unknown economy, and obliged each grade of society to content itself with a lower step in the ladder of life. At the same time, the system of labour was thoroughly disorganised, not only by the exigencies of the war, but by the measures in progress for the total abolition of slavery, and the continued cessation of the Chinese immigration.

But Cuba, like Spain itself, is a country altogether *sui generis*, having all the determination and tenacity of purpose which so distinguish the Spanish people, not to be daunted by difficulties, whatever the present sacrifices or future consequences may be;

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\* This Report is extracted from Blue Book, "Commercial, No. 1, 1878," for the information of the West India Committee.

for what other country, having a population of little more than 1,000,000, would or could have maintained for ten years, entirely from its own resources, a war which has obliged it to support a formidable fleet of ironclads, and other first-class ships in Havana, and an army of 100,000 men in the field; or what other people would have submitted to raise a war revenue of £3,422,690 by an income tax of 30 per cent., in addition to the heaviest import and export duties upon all that it consumes, all that it produces, and all that it uses? The revenue derived from the custom-house amounted to about 22,000,000 dols., or £4,400,000, and from the municipal taxes to about 6,000,000 dols., or £1,200,000, in the whole to £9,000,000 sterling, and yet this has all been done and continues to be done, without any very extraordinary shock to the trade or commerce of the island.

The 30 per cent. war tax having given rise to an international question, and having been, moreover, very much misunderstood in England, it may be as well to state the exact position in which foreigners were placed in regard to it. The exigencies of the Government, in consequence of the civil war, obliged it to place a war tax of 30 per cent. on income, 25 per cent. on import and export duties, 10 c. the half-ounce upon all letters arriving from abroad, and indeed upon everything that could possibly be assessed. The first portion of this tax, more from the difficulty of fairly assessing it than from its amount, met with the greatest opposition from foreigners, more particularly when it was found that the Germans were exempted from it.

It was raised in the following manner and proportions :—

	Assessment.		Amount.	
	Dols.	c.	Dols.	c.
Town property .....	13,473,136	00	4,041,940	99
Country „ .....	26,183,581	47	7,855,074	44
Trade and Commerce....	16,073,327	41	4,821,998	22
Professions and arts ....	1,314,798	93	394,439	67
Total .....	57,044,844	46	17,113,458	32
	£	s. d.	£	s. d.
Or .....	11,408,561	19 6	3,422,691	13 4

The total value placed upon these heads of property was 83,423,135 dols. 85 c., or £16,684,627 3s. 4d.; but as it would have been grossly unjust to have taxed a man's outlay as part of his income, 43,766,417 dols. 73 c. (£8,753,283 5s.), or somewhat more than one-half his gross income, was allowed for expenditure, the total amount actually levied being, as above, £3,422,691 13s. 4d.

The exemption of the Germans from the tax caused very great discontent amongst other foreigners, as well as the Spaniards themselves, who were greatly prejudiced in their business by a privilege which enabled the former to undersell them; and British and American merchants particularly felt the hardship, owing to the similarity of their commercial transactions. Some resisted the payment, but their goods were embargoed and they were fined.

But there was absolutely no help for it. The German Government had made a treaty with Spain by which all its merchants were secured against any war contributions whatever; hence the difficulty. The Germans naturally insisted upon their treaty rights, the Spaniards and other foreigners protested against partiality, and the Government was powerless to act; for it could not comply with the wishes of its own people, and other foreigners, without outraging the treaty rights of others.

The British merchants imagined that they could claim the rights of the "most favoured nation;" but, unfortunately, the treaty with Spain, which contains that clause, does not apply to the colonies.

An arrangement has at length been arrived at between the Spanish and German Governments by which all foreigners, including Germans, are to pay 22½ per cent., whilst the Spaniards continue to pay 30 per cent.

There were also objections to the mode of assessment; but, bearing in mind the extreme difficulty of fairly assessing an income tax, I think that the Government hit upon the simplest way of solving it by adopting that upon which the municipal 6 per cent. tax was based, and multiplying so as to arrive at 30 per cent.; and it has always shown a praiseworthy desire to entertain any complaints respecting over-assessment.

Since writing the above, the Government has issued a decree that those foreigners availing themselves of the 22½ per cent. rate

will not be entitled, as heretofore, to an abatement of 5 per cent. upon their payments, nor will any money but gold be received from them; so that I fear that this vexatious question will inevitably be re-opened.

The loan commonly known as the Calvo Loan, of 30,000,000 dols., was successfully negotiated last year upon the security of the Custom-house duties, expressly to be devoted to the extinction of the rebellion. It is now expended, and 25,000,000 dols. more are to be advanced by the same persons upon the same security. I fear that this may lead to enhanced duties upon imports and exports, increasing financial embarrassment and further disorganization of trade.

*Agriculture, Trade, and Commerce.*

There are in the Island of Cuba 69,515 town properties, termed "*fincas urbanas*;" 1191 sugar estates, or "*ingenios*;" 192 coffee plantations, or "*cafetales*;" 3172 cattle estates, or "*potreros*;" 4511 tobacco estates, or "*vegas*;" and 17,094 "*estancias*," or smaller properties, all of which are termed "*fincas rusticas*."

The chief staples of production in the Island of Cuba are sugar and tobacco, the best that the world produces. Coffee, although extensively grown, is no longer an export, and large quantities are imported from Porto Rico. The same may be said of timber, which was once largely exported; but owing to the indiscriminate way in which the forests have been destroyed, either for fuel in the manufacture of sugar, or as fences for the *potreros*, the exportation has ceased.

It is not to be denied that the production of sugar has been somewhat affected by the civil war; but other agents have been at work of equal importance. For example: the immense quantities of beetroot sugar produced in France, the suspension of immigration, and the disorganization of labour by the gradual emancipation of the slaves. I confess that I do not join the jeremiads respecting the impending ruin sure to arise from the decrease in production. It appears to me that, in spite of the civil war, in spite of beetroot sugar, and in spite of the cessation of immigration or the emancipation of the slaves, the sugar-planters in Cuba cannot complain of diminished production.



Take the last ten years. In the first five, immigration was in full force, and, during the last five, immigration ceased; and the figures are in singularly similar gradation, the sole exception being that two short years come together in the last section.

## GROSS PRODUCTION OF SUGAR.

For five years—	Tons.
1868 .....	709,609
1869 .....	664,155
1870 .....	684,032
1871 .....	527,000
1872 .....	667,850
Second five years—	
1873 .....	738,000
1874 .....	666,000
1875 .....	699,900
1876 .....	566,266
1877 .....	500,000

The two totals are respectively 3,253,646 and 3,171,166 tons, leaving a difference in favour of the first quinquennial period of only 83,480, or 16,696 tons a year.

That which the planters do suffer from is the crushing amount of taxation imposed upon them, and which is literally driving the country to irretrievable ruin. One gentleman, whose splendid estates I visited, actually pays £30,000 a year in war taxes, besides which, everything he imports for his slaves, contracted Chinamen and freemen, every piece of machinery, is charged with heavy import duties. The costly machinery upon his vast estates, together with the plant of his private railroad, cost him 7,000,000 dols., or nearly £1,500,000.

All that I had hitherto seen in Brazil and the other West India Islands was Lilliputian compared with these grand establishments. Everything is done, where possible, by steam machinery, from the ploughing of the fields to carrying the canes to the mills for crushing, boiling (by steam), purifying, and all else necessary for their transformation into sugar, when it is packed by steam, sent by his own steamers to the Havana, and there shipped to its destination abroad.

He told me that he substituted iron for flesh wherever possible, but, notwithstanding this, he employs 4000 men on his five estates—say 2000 slaves, 400 Chinamen, and 600 freemen; and I bear witness that, notwithstanding it was crop time and the people worked very hard, they looked healthy, fat, and well treated. The cost of his people he gave me as follows: a Chinaman, £50 a year; free negro, £60; slave, £40.

Regarding the accusation made against the planters, that, having contracted with the Chinese for gold, they paid them in deteriorated paper, he assured me that he had always paid his people in the coin contracted for; that of those re-contracted he had men on his estates, some contracted for gold and some for paper, and at wages according to their capacity and value.

He said that I should observe, in riding about the country, fine estates, with machinery and works in perfect order, abandoned from the inability of the owners to meet the heavy taxation and import and export duties imposed, and which, if long continued, would bring hopeless ruin upon the whole country.

All this I saw; and if it be added that in the central parts of the island the planters are in constant dread of having their crops burnt by runaway slaves, or contracted Chinamen, it will be seen that the state of a planter in Cuba is not an enviable one.

Next to the perfection of the machinery, that which particularly struck me was the slovenly state in which the cane-fields were kept, contrasting very unfavourably with those which I have seen in Brazil, and even in Porto Rico. The cane itself is a thin, lanky, miserable-looking plant, and no attention seems to be paid to weeding and cleaning the fields. The mass of rubbish thrust into the mill with the consumptive-looking cane is quite astonishing, and probably necessitates the palatial factories and costly machinery with which it is cleansed and purified, and finally arrives at the perfection for which Cuban sugar is celebrated. The agricultural portion of the process of growing and making sugar appears to be neglected, and every attention expended, and no expense spared, in its manufacture.

The value of the sugar crop this year is probably £10,000,000.

I have had no time to visit any tobacco or coffee estates or cattle pens. I had proposed to myself to visit the Vuelta Abajo, where all the celebrated tobacco known as "Havana" in Europe is grown. This year's crop has been the largest ever known, and is also of the finest quality.

It is not easy to arrive at the quantity of tobacco actually produced in this island. It is probable that the greater part of the inferior qualities is made into cigarritos, and picadura for pipes, and that the real Vuelta Abajo tobacco is almost, if not entirely, devoted to cigars. A great deal of leaf tobacco is exported, as well as cigars, cigarritos, and picadura; but the home consumption of cigarritos is so great that the aggregate production must be enormous.

Until a few years ago large quantities of tobacco were imported from Porto Rico to adulterate that of the Vuelta Abajo, but as those celebrated cigars suffered in reputation from contact with the inferior article, the Government placed a prohibitory duty upon its importation, and the adulteration is now confined to the poorer sorts grown in the island.

The tobacco crop of this year will be probably worth £5,000,000 sterling. The growth of coffee is insufficient for the consumption of the island.

The quantities of rum and molasses are not great. There is very little left to make either, after the cane has gone through its thorough process of being turned into sugar, by the searching machinery through which it passes.

The ports open to foreign commerce are—upon the north side, Havana, Matanzas, Cardenas, Caibarien, Sagna la Grande, Nurvitas, Gibara, and Baracoa; and upon the south, Santiago de Cuba, Guatanamo, Manzanillo, Tunas, Trinidad, Cienfuegos, and Batabano, of which Havana is immeasurably the most important,—two-thirds of the sugar and all the tobacco being exported from it.

Ale, rice, salt, iron, coal, machinery, linen, cotton, and silk-manufactured goods are sent from Great Britain; lumber, and salt fish from Canada; cotton goods, machinery, flour, and provisions from the United States; beer, provisions, false jewellery from

Germany; linen, cotton, and silk manufactures, wine, &c., from France; dried beef from the River Plate; and linen and silk manufactures, wines, fruits, and provisions from Spain.

The import duties are exceedingly oppressive. The tariff is unintelligible, or requiring long study, and may be said to be arbitrary, with 25 per cent. additional for war tax.

The export duties are 2 dols. 30 c. gold, or say 8s. 4d., upon each box of 400lbs. of sugar; 1 dol. 50 c. gold, or say 6s., upon every 1000 cigars; and 2 dols. 50 c., say 9s., upon every cwt. of leaf tobacco, with 25 per cent. additional for war tax upon each.

There were the most unjustifiable fines imposed for the slightest errors in invoices or manifests; but they created so much indignation abroad that I am happy in being able to report that they are no longer inflicted. During my tenure of office, not one has been imposed upon our countrymen in Havana, and the few there have been, at the outports, have been immediately removed upon my making a friendly representation to the authorities.

The crop of sugar, it will be seen by the annexed statistics (No. 1), is the smallest known for many years, and, although only 13 per cent. less than that of 1875-76, is 30 per cent. less than that of 1874-75. Had it not been for the partial rise in prices which took place early in this year, it would have been infinitely less; but the planters, encouraged by the favourable prospect, continued to grind much later than is usual.

There was a great decrease in the export of sugar. The principal customer of Cuba, the United States, took 60,000 tons less this year than last; and the whole of Europe only 33,000 tons, against 96,000 last year and 163,000 in 1875. The stock remaining on hand on the 31st of July was 105,000 tons, against 63,000 tons last year.

The deficit in the export of molasses is still more remarkable. The total production is only 100,000 tons, against 150,000 last year and nearly 200,000 in 1875. As usual, almost the whole was shipped to the United States.

It is somewhat early to speculate on the coming crop of 1877-78, but there is nothing to show that it should exceed the present one;

for although the cane-fields show a very fair aspect, the old plants are not likely to prove productive, owing to the drought at the early part of last year, and the effects of the hurricane; added to which, the scarcity of labour is daily increasing, owing to the expiring contracts of the Chinese labourers, who naturally prefer the more independent life of a town to the hard work of the country, and this has, in many instances, prevented the indispensable renewal of the planting stock.

I have said that the present crop of tobacco is the best in both quality and quantity known for many years. The last was deficient in both, which was doubtless the cause of the great falling-off in the export of tobacco. The old average export of cigars was 4,000,000 a week, but to the present date only 88,516,000 have been shipped, against 139,184,000 in 1876. There has been, however, an increase in the export of leaf tobacco, 8,512,400lbs. having been shipped, against 5,891,050lbs. in 1876.

There is one remarkable fact connected with leaf tobacco, that of the 5,891,050lbs. exported in 1876, 5,019,300lbs. went to the United States; whereas of the 8,512,400lbs. exported this year, 4,617,900lbs. only went to the United States; and Spain, which in 1876 took only 580,600lbs., has taken this year 2,040,800lbs., which leads to the conclusion that Spain intends competing with its colony in the manufacture of cigars.

Owing to the excessive import duties into the United States, almost prohibitory as regards cigars, 1500 cigar factories have sprung up in that country to enjoy the advantages of this protection by importing the leaf and selling their countrymen inferior cigars.

63,314,000 cigars were exported to Great Britain in 1876, and 49,329,000 in 1877. The best cigars are sent to England, to Rio de Janeiro, and the River Plate.

The island depends very much upon her coasting and home trade with the capital, as most of the towns in the central department are under the influence of the insurgents. Their commerce is, therefore, carried on by sea, in small coasting vessels or in fine steamers which ply along the coast.

There are six banks in Havana—the Spanish Bank, the Commercial, the Industrial, the St. Joseph's, the Alliance, the Marine Insurance, and the Caja de Ahorros, or Savings Bank, Santiago de Cuba. Matanzas and Cardenas also have banks.

The former of these is the Government Bank, through which is issued all the Government paper—issued with its sanction but not in its name, and now amounting to about 63,614,674 dols. As this currency is the only paper which is legal tender (no other bank being one of issue), and as it is no way guaranteed by the Government, and is, of course, inconvertible, and now at a discount of 128 per cent. as regards gold, it is impossible to conceive how a great financial catastrophe is to be avoided. All business transactions are carried on in this worthless currency, and, when the smash arrives, the other banks, which are in themselves solvent, will be inevitably ruined.

#### *Shipping and Navigation.*

I regret to report a diminution in the numbers of shipping at the port of Havana during the past year. From the 1st January to the 30th June, 1875, 1005 ships of all nations, measuring 438,263 tons, entered the port of Havana; during the same period in 1876, 965 vessels, measuring 423,030 tons; and in 1877, 941 vessels, measuring 449,785 tons, one-half of which were American. But the decrease in British shipping has been very remarkable, their numbers, during the above periods, having respectively been 113 in 1875, of 52,382 tons; 59 in 1876, of 29,768 tons; and 85 in 1877, of 52,695 tons. These figures give an erroneous impression, from the Government keeping its shipping statistics in half-years—tallying with the time of the crop; but my own register gives 153 ships for the whole of 1876, showing a diminution in British shipping of 20 vessels, as compared with 173 vessels in 1875.

Almost the whole of the British vessels entering Havana are Canadians, the nature of their cargoes being usually lumber, coal, or provisions, enabling them to disregard the differential duties placed upon the flag. But these duties are fatal to vessels coming from the United Kingdom, and the few vessels that do are loaded with coal, beer, or some such cheap articles; but our costly manu-

factures, machinery, &c., all come in Spanish bottoms, and there is a regular line of steamers trading between this and Liverpool under the Spanish flag, although, I believe, mostly owned by British subjects.

As the differential duties upon the flag prevent our importing our productions in our own ships, and as our export of sugar from Cuba is comparatively small, we should not have so many British vessels here were it not for the carrying trade, which is almost entirely in our own hands, a great proportion of our ships carrying sugar even to the United States.

I enclose shipping returns from the ports of Havana, Matanzas, Trinidad, Cienfuegos, Cardenas, and Gibara. I regret that they are not complete; but I have received no returns from Santiago, Manzanillo, Caibarien, or Batabano. They will, however, give valuable information as far as they extend.

Freights have been extremely low, and the following may be considered an average quotation:—

	Loading at Havana.	Loading at Outports.
British Channel & orders :		
Sugar.....Boxes	32s. 6d. to 35s.	Nominal.
„ .....Bags.	27s. to 30s.	32s. 6d. to 35s.
„ .....Hhds.	37s. to 37s. 6d.	37s. 6d. to 40s.
Molasses .....	2 $\frac{3}{4}$ dols. to 3 dols.	3 dols. to 3 $\frac{1}{4}$ dols.
United States :		
Sugar .....Per box.	75 c. to 80c.	....
„ ..... „ bag.	40 c.	....
„ ..... „ hhd.	3 dols. to 3 $\frac{1}{2}$ dols.	3 $\frac{1}{2}$ dols. to 3 $\frac{3}{4}$ dols.
Molasses .... „ „	2 $\frac{1}{4}$ dols. to 2 $\frac{1}{2}$ dols.	2 $\frac{3}{8}$ dols. to 2 $\frac{1}{2}$ dols.

Pilotage differs in amount at each port, according to the number of masts a ship has, and the natural difficulties of entry and exit. The ports are well lighted, and the greatest care to prevent casual is always taken by the captains of the ports.

Ships are built in Havana, and a steamer was launched a few days ago; but this sort of enterprise is, like many others, in

abeyance, not from any distrust in the permanence of the Government, but from the crushing effects of taxation, which is absorbing all capital.

*Population and Industries.*

Ethnologically the population of Cuba consists of three races—the European, Asiatic, and the African, the American having been entirely annihilated by the former. The Europeans are represented almost exclusively by the Spaniards, the Asiatics by the Chinese, and the Africans by the negroes; but the number of Asiatics is so small, probably not more than 50,000 or 60,000, that they may be removed from this consideration. The European or Spanish race is said to number 800,000, and the African or negro, with the varieties consequent upon the mixture of the two, 600,000, out of a population of 1,396,530, thus classified in the census which was taken in 1861:—

	Number.
White males .....	468,087
„ females .....	325,397
Free coloured males .....	113,806
„ females .....	118,687
Slaves, male .....	218,722
„ female .....	151,831
Total .....	<u>1,396,530</u>

But I extremely doubt if the population of Cuba now greatly exceeds 1,000,000.

It will be seen that the Chinese are, as a separate body, excluded from this estimate, and if they are omitted altogether it may be one of the causes of the asserted increase of the population in 1864 to 1,500,000, the greatest amount ever quoted. The importation of Chinese coolies commenced in 1847, and ceased in 1873, during which period 116,267 were actually landed in Havana. These would have naturally formed the nucleus for an extension of the population by an industrious, sober, and tractable race, had not the exportation of women been prohibited by the Chinese Government; but it is highly probable that the cupidity of those engaged



in the traffic was one, if not the only cause, of the emigration being confined to men, who could so much better support the hardships of the voyage, who would scarcely consume more, and who could take care of themselves; but whatever the cause, an immigration, intended to increase the labour power of the island, from its very beginning bore the seeds of its own decay, and never could have proved, under the circumstances, anything but a temporary relief for the evil sought to be cured by it; in all probability there are not now 50,000 coolies in the island. In like manner the cessation of the civil war in America, and the outbreak of the insurrection caused the Americans who had desired to settle here to return to their own country; but the most serious causes of the decadence in the population of the country must be attributed to the insurrection itself, and the atrocities which disgraced its commencement; these struck terror into the inhabitants, and those who escaped death in the field, execution at the garrotte, or by court-martial, were glad to leave the country and to return to Spain, or to seek refuge in the United States, Jamaica, or the South American Republics; and the tenacity with which the war has been continued has naturally ruined the finances of the country, and occasioned an amount of taxation almost incredible and altogether insupportable, adding an additional incentive to depopulation.

My predecessor considered that in 1870 the population did not exceed 1,200,000, and I believe that it has decidedly decreased ever since.

It is, however, an undoubted fact that the present amount of population is entirely inadequate to the wants of the country, and unless the rebellion is speedily suppressed, it will continue to decrease, and with it the productions and wealth of the island must decrease proportionately; for it is not only the numerical deficiency of manual labour that has to be contended against, but even that which exists is taxed to supply volunteers, police, and a host of other agents, the creations of the war; and there are even rumours of the conscription being introduced into the island, although I consider such a notion to be too wild to be really

entertained. The Chinese cannot increase, and for some mysterious reason or other the negroes do not, the mortality amongst their children being described as fearful and altogether unaccountable.

Thus, the only two races in the island capable of out-door labor are diminishing in numbers, through natural causes, and at the same time slavery and forced labour are becoming extinct through the operation of the laws. Firstly, the Chinese immigration has ceased for some years, and the contracts of those that are here are gradually expiring; and, secondly, the "Moret Law" is as surely extinguishing negro slavery. By this law all children born of slave parents after the 17th September, 1868, and all slaves attaining sixty years of age were freed; for certain services in the field, under the Spanish flag, slaves were freed; and numbers freed themselves or are freed by their masters. In 1875 the Junta of Colonization published a report of the operations of the law to that date; unfortunately, however, no return is made for the city of Havana, but even with that great omission 50,046 slaves are reported to have been emancipated during the seven years from September, 1868, and May, 1875; thus, 32,813 were born free, 13,740 freed on account of age, 301 freed for service under the flag, and 3192 freed through other causes. I have no reason to doubt the correctness of this report, and, therefore, taking the 50,046 as a commercial basis, about 7000 a year become free, and consequently to this date it may be estimated that about 64,000 slaves have been freed, without calculating those in Havana, respecting whom no data exists.

Leaving Havana, therefore, out of the question, there probably remain for agricultural purposes about 300,000 people; that is, say 250,000 negroes and 50,000 Chinese, and 500,000 more are urgently required to maintain the productions of the island at their present amount; the question is, where to look for them! The negro is beyond all comparison the most valuable immigrant for the tropics, no other can withstand lengthened field labour better than the coolies, who are equally valuable in the manufacture of sugar, but cannot withstand the effect of exposure to sun and rain; but free emigration from Africa has not taken the place of slave

trade, and the island can look only to the coolies to supply its wants. The Spanish Government is, I hear, making strenuous efforts to induce the Chinese once more to permit emigration to Cuba of its redundant population, and it is to be hoped that it will succeed, but it would be well to organise the service under its own responsible agents to prevent abuses, and for the Chinese Government to appoint a Consul here to protect their immigrants, not from the oppression of Government, but from the many rascals who infest Havana, deceive and rob these poor people, and make a harvest out of their ignorance. I have never, until now, I regret to say, known any arbitrary or unjust act practised upon them by the Government; on the contrary, the permission allowed them at the expiration of their first contract to naturalize as Spanish subjects, or to choose a foreign consul, through whom they obtain a cedula, is an act of the greatest humanity and liberality; nor do I believe that they are ill-treated upon the estates at which they work; those I have seen here are well paid, well fed, and well clothed. In one respect they are worse off than the negro—the absence of females debars them from the enjoyment of every domestic tie; and in any renewal of Chinese emigration the Celestial Government should insist upon a proportion of women being embarked with the men.

But this liberal and humane course has been infringed by a law, of which it is impossible to speak without indignation, obliging every Chinaman at the expiration of his final contract to renew it for a second term, or immediately to leave the country. Neither the exigencies of the war or the want of labour can justify so gross a breach of faith. No one will more regret it than those who are the best friends of the Spanish Government, for it is probably the chief, if not the only, cause why Chinese are found in the rebel ranks, and why the Chinese Government have stopped the emigration; besides, so tractable, peaceable, and industrious a body of men were altogether undeserving of such treatment, for hitherto, after completing his first contract, the Chinaman has not become a vagabond, but, with his national aptitude for business, has established himself, and by industry and frugality many have

become rich and prosperous citizens. As an instance of their progress, I may mention that they maintain more than one well-conducted theatre.

With my high estimation of the humanity and justice of the Spanish Government, I am astonished that it should have sanctioned a course which renders it liable to the charge of a renewal of slavery under another name, and thus defeat that which must be the principal object of its desires,—a free and copious immigration.

A company or society has recently been formed here, under very distinguished auspices, for the importation of Chinese labourers. The general regulations appear to be admirable. It is proposed to bring them without any engagement here, so that they would be free to choose their own work. 25 per cent are to be women, and a Chinese consul appointed (if the Celestial Government will do so) to protect them; but the rule that they should not be allowed to change their nationality unless it be to become Spanish appears to be arbitrary and useless.

Cuba, to be restored to its former prosperity, requires peace, economy, and extended immigration, and all its well-wishers must hope that it will be successful in establishing the whole, and re-asserting its right to the names of the Pearl of Antilles, and the Key of the Gulf, once more.

#### *Public Works.*

There are several railways, starting from Havana, in which considerable British capital is embarked. Of these, the most remarkable for its rapid progress is the Cardenas and Incaro; it was established in 1845, with a capital of 937,000 dollars, or £187,400, and now its capital in stock, plant, &c., is 8,000,000 dollars, or £1,600,200; it pays a dividend of 10 per cent. per annum; it is in the midst of the sugar district, and is connected with Havana by the Sabanilla, Havana, and Mantanzas and the Havana railways. The western part of the island, from the Cinco Villas to Batabano and Havana, is well provided with railways, and when the line from the capital, by the western railway to the Vuelta Abajo, is completed, all its most important channels of communication will be open. Railway property, with the exception of the Cardena and Incaro, is not a favourite investment.

There are shorter lines starting from Havana,—the Bay of Havana and the Marianas; the latter, a short line to a favourite summer residence, has lately been purchased by the English shareholders, together with its debts, for £50,000, and under the new management is earning 14 per cent. on its working expenses, so that when the debts are paid it ought to prove a paying concern.

Telegraphs radiate from Havana to all parts of the island, but, owing to the insurgents being in possession of the central districts, telegraphic communication, between the extreme departments and the central coasts, has to be carried on by submarine telegraph. There are two submarine telegraph companies, the Cuba and the West India and Panama, both English companies, but dependent for their European communications upon the American companies.

I have nothing to add regarding roads, canals, or bridges; the former are naturally neglected, where everything is devoted to railways. I know of no canals or of any remarkable bridge; those in the neighbourhood of Havana are well and tastefully built, but the absence of large rivers prevents the construction of magnificent bridges.

*Havana, August 22, 1877.*

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TRAITÉ THÉORIQUE ET PRATIQUE DE LA FABRICATION  
DU SUCRE, COMPRENANT LA CULTURE DES  
PLANTES SACCHARINES, L'EXTRACTION DU  
SUCRE BRUT, LE RAFFINAGE, &c.

PAR DR. E. J. MAUMENÉ.

*(Continued from page 192.)*

Of course, normal sugar, before it can undergo fermentation, must be subject to a modification, and become converted into fruit sugar. That this is so may be easily proved by passing a solution of normal sugar several times through a filter containing some fresh yeast, and then polarising it, when it will be discovered that the normal sugar has been converted into fruit sugar. This changement is very

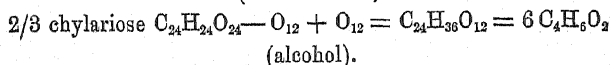
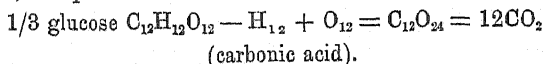
simple, the normal sugar having combined itself with a little water, and become converted into the fruit sugar— $C_{12} H_{11} O_{11} + HO = C_{12} H_{12} O_{12}$ ,—and it is only after this transformation has taken place that fermentation sets in, and the solution become salcoholic; and, when the fermentation is complete, all the sugar in the solution has been completely destroyed. Oxygen is necessary to set the ferment in motion, although it does not seem to be necessary to its continuance. In reference to this, we give the experiments of Gay-Lussac, who was the first to prove this question:—"Having put some grapes, perfectly intact, into a bell jar, and, after having put it over mercury, I filled it, fivetimes in succession, with hydrogen gas, in order to get rid of all traces of atmospheric air; after that, I crushed the grapes, in the jar, by means of an iron rod, and exposed it to a temperature of from  $15^{\circ}$  to  $20^{\circ}$ . Twenty-five days after, no sign of fermentation was manifested, whilst in some 'must,' to which I had added a little oxygen, it appeared the same day. In order to satisfy myself that, to the want of oxygen, was due the non-fermentation of the contents of the first jar, I introduced a little oxygen into it, and, in a short time after, a brisk fermentation set in. I noticed in these two experiments that the oxygen was completely absorbed, but I cannot say whether it combined itself with the carbon or with the hydrogen. I obtained a volume of carbonic acid gas twenty times larger than that of the oxygen I had added to the raisin 'must.' From this it is evident that if the oxygen is necessary to commence the fermentation, it is not necessary to continue it, and that the greatest part of the carbonic acid produced is the result of the mutual action of the principles of the ferment and of the sugary matters. In another experiment of the same kind as the above, fermentation made its appearance on the twenty-first day, but in this case the 'must' was far gone; whereas a portion of the same 'must,' put in contact with a little oxygen, fermented in thirty-six hours after having been prepared."

In this action the temperature has a great influence. According to Quevenne, who has studied this subject, if we expose, to a gradually increasing temperature, a liquor formed of 10 parts of sugar,  $1\frac{1}{2}$  of yeast, and 35 of water, the disengagement of carbonic acid becomes

more and more rapid up to the temperature of  $55^{\circ}$ ; towards  $60^{\circ}$  a slight decrease is apparent, but at  $75^{\circ}$  the gas begins to generate with increased vivacity, which is continued for some time even to  $100^{\circ}$ , until the sugar has undergone all the modification it will. This modification is not only a simple alcoholic fermentation: it gives birth to other products. Let us leave the same mixture for several hours at  $15^{\circ}$ , and then carry it quickly to  $100^{\circ}$ , and we obtain only  $1/30$  of the alcohol the sugar can produce. If another portion of the same mixture be heated to  $55^{\circ}$ , the fermentation, which lasts several hours and stops of itself, produces only  $1/52$  of the alcohol one could obtain under favourable conditions. And, if we leave a third mixture at  $35^{\circ}$  during five hours, we obtain the  $3/4$  of the alcohol indicated by theory, so that at this temperature the sugar undergoes only an incomplete fermentation. It is necessary, then, never to pass the limit of  $30^{\circ}$ , if a complete alcoholic fermentation is wished for. The products formed at the other temperatures have never been studied. As to the gas generated, it is always perfectly pure carbonic acid. Cold acts as a great preservative against fermentation. By cooling a mixture, same as above, to  $6^{\circ}$  or  $5^{\circ}$ , alcoholic fermentation ceases, the yeast is altered, and the sugar breaks up into other compounds. At zero and under, all action ceases, and if the solution becomes solid, on account of the low temperature, the sugar and ferment are perfectly preserved, and may, even after a long lapse of time, on exposure to a proper temperature, be first liquified, and then made to ferment, as if no solidification or stoppage of action had taken place. We see, then, how very limited are the temperatures favourable for the alcoholic fermentation, as we must operate between  $20^{\circ}$  and  $30^{\circ}$  in order to obtain proper results. Certain fermentations are produced between  $10^{\circ}$  and  $20^{\circ}$ ; below  $10^{\circ}$  the formation of alcohol is very slow and difficult.

With regard to the action and chemical nature of the ferment, our author considers the theory of the animalculæ and vegetation ferment to be rather untenable, and that the alcoholic fermentation is due rather to capillary attractions dependent on affinity. The solutions of sugar and of nitrogenous matters are two liquids of very different natures. They determine a *mégosmose* and a *microsmose* through the

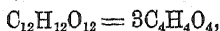
walls of the starch globules. *The osmose induces the decomposition of the sugar* (or rather of the sugars, because in the compound named *grape sugar* two different sugars exist), and the osmose draws from the globules the nitrogenous matters. The juice of the grape, at the moment of expression, presents in the liquid state, a mixture of two very distinct matters—the one starchy, destitute of nitrogen; the other albuminous, nitrogenous. As soon as united, these two matters, which were separated in the grain, give birth to the globules; the first takes a solid state and forms the envelope, while the latter is enclosed within this envelope. The globule introduced into the sugar solution becomes the seat of the osmose of the sugars with the nitrogenous matters. The two sugars, glucose and chylariorose, of which grape sugar is always formed in unequal proportions, and in which the *physical structure is not the same* although their chemical composition may be identical, undergo different modifications. The one, the solid sugar, is oxidised; it undergoes combustion, and all its carbon goes to form the carbonic acid; the other, the liquid sugar, in giving its oxygen to the first, in order to produce carbonic acid, receives in exchange a same number of equivalents of hydrogen, and constitutes the alcohol. The nitrogenous matters exercise, in this decomposition, an influence easily comprehended—they determine osmose powerful enough to bring about the destruction of the sugar. A very simple supposition will show how the alcohol and carbonic acid are produced. Admit that the grape sugar contains a third of glucose, or solid sugar, and two-thirds of chylariorose, or liquid sugar; the glucose will take the half of the oxygen from the chylariorose,  $O_{12}$ , and will cede to it in return all its hydrogen,  $H_{12}$ ; its carbon will pass totally into carbonic acid, and, on its side, the chylariorose, augmented by the hydrogen of the glucose, will produce the alcohol.



But, quite *independent of osmose*, is this supposition correct?—Is grape sugar formed of one-third of glucose and two-thirds



chylariorose? It is very difficult to satisfy one's-self on this point. Glucose and chylariorose appear to be two isomeric varieties of the same *kind*, of the same sugar,  $C_{12}H_{22}O_{11}$ , varieties which can pass from the one to the other under numerous influences—*time*, acids, osmose, &c. Keeping in view this variability, we may admit that the osmose produced by globules of a *certain thickness* transforms the proportions of the glucose and the chylariorose into a third and two-thirds, and determines at the *same time* the action, of which we have just spoken. As we have said before, there are other products formed, although their proportions are very small. They are essentially composed of glycerine, succinic acid, and some other matters not yet determined. The weight of these last is about the half of the weight of the glycerine. Many authors also give acetic acid, which they consider as a normal product of fermentation, and this appears to be established by the remarkable experiment of Vanquelin:—"In order to make vinegar, and in order to assure one's self that no other body contributes to the formation of the acetic acid, we must employ distilled water deprived of air, and some well-washed yeast. The sugar is dissolved in the water, and the ferment is added to it. The mixture is put into a flask and well corked, and then exposed from twenty to thirty days to a temperature of from  $20^{\circ}$  to  $25^{\circ}$  Reaumur. At the end of this time the liquid is converted into vinegar; it is then distilled, in order to separate it from the ferment, and the small quantity of sugar left undecomposed." The origin of the acetic acid is very uncertain. Some, far from admitting the equation,



in which the acid is derived from the sugar, after inversion, believe its formation is due to a decomposition of the *levûre*, as this body left to itself, *without oxygen and without sugar*, forms acetic acid; while others, having obtained a weight of acid superior to that of the *levûre*, throw it exclusively on the sugar.

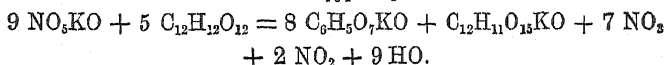
The effects of the osmose depend more on the thickness of the membranes than on the chemical nature of the two bodies submitted to osmose; these latter act the one on the other, only in an indirect

manner—that is to say, in modifying more or less the direct action of the membrane on each of them. Now, the direct action of this membrane depends chiefly on its thickness, and induces no exchange of elements, either between it or the bodies submitted to osmose, or between the two bodies themselves. The quantity of sugar *fermented* depends on the proportion of nitrogenous matters, and of the sugar solution placed before and behind the membrane. It is determined by three conditions: the density of the nitrogenous matters; the density of the sugar solution; the density, the thickness of the organic structure of the membrane. It serves as a measure of the result of the forces of attraction put in play under its influences; it might then be variable, if the globules of the ferment were not always of the same size, and in consequence the same membrane, and the same nitrogenous matters, so that we are obliged to add to it the same proportion of sugar; and, in any case, it can be very great, comparatively, to the quantity of ferment, since it is not this quantity, but the structure, which causes the molecular movement of the grape sugar, or the two sugars of which it is composed.

In certain cases, several special decompositions of salts, or other organic matters, are produced, so similar to those of the fermentation principles, alcohol, carbonic acid, &c., that the observers have not hesitated to consider these actions as true fermentations, notwithstanding the absence of the special ferment that the same observers hold to be necessary: but, apparently, they saw in these decompositions a foreign influence which certainly did not exist. In the large quantities of melasse put in fermentation in order to produce alcohol, a disengagement of red vapours has often been observed. Many chemists have tried to explain this remarkable fact, but, for want of a true scientific indication, they have only seen it in a special fermentation—the *nitrous fermentation*—each fermentation being due, according to these chemists, to a particular ferment. This is rather a peculiar idea, because nitrous acid appears to be one of the most hostile bodies to the life of the ferments; but, notwithstanding this knowledge, given by a simple and incontestable fact, no one seems to have been able to overstep this track, and so an hypothesis, so clearly untenable, has been developed with a zeal

worthy a better cause. It is very easy to show that the nitrous fermentation is a dream; the production of the red vapours result from an action, determined by water, on the mixture of glucose and nitrate of potash, with which the beetroot juice is always charged. This is an action of mixture of the glucose with the nitrate of potash. We have—

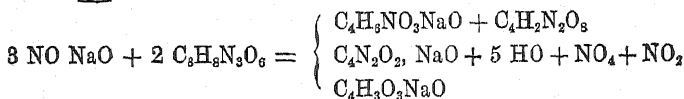
$$n = \frac{1.80}{1.01} = \frac{8}{5}$$



But the production of these red vapours may be due to matters other than the glucose. Let us consider, for example, the action of asparagus and of nitrate of soda:—

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$$n = \frac{1.82}{1.09} = 1.55 = \frac{3}{2}$$



We can produce the aspartate of the dicyanate of the acetate of soda, the dibébazhigne acid, the red vapour  $\text{NO}_4$ , and the bioxide  $\text{NO}_2$ , which in contact with the air produces a second equivalent of this vapour. The beet syrups, towards the end of the boiling, disengages some bioxide of nitrogen, and, in the air, this gas becomes immediately red vapour. Descroizilles explained it by the employment of the sulphuric acid destined to saturate the lime, and of which an excess decomposed the nitrates; but Tilloy observed a disengagement from an alkaline syrup, and besides we have observed it in the alcoholic fermentations. Tilloy suggested, in order to do away with it, to boil the syrup for a moment with double its weight of water, and three or four ounces of sulphuric acid, which disengages a considerable quantity of carbonic acid. After this treatment, the alcoholic fermentation is regular, and gives the best products without any disengagement of nitrous gas. Schlöesing has shown that the decomposition of the nitrates can take place under the influence of organic matters. Dubrunfaut attributed it to the absence of a sufficient quantity of *levûre*; the fermentation becomes latic, and

this acid decomposes the nitrates. Sugar undergoes other decompositions, very different from those which constitute the alcoholic fermentation. Thus, if boiled *levûre* be added to a sugar solution, in a few minutes it will be changed into a viscous substance, sticky, mucilaginous, uncrystallizable, and which is precipitated by the addition of tribasic acetate of lead. This matter has never been completely studied; we only know that it may be represented in its composition by carbon and water (that is to say, oxygen and hydrogen, in proportions convenient for their production). That this is mucilage may be very probable, because the presence of mannite is always observed in this fermentation. During this fermentation, as during the alcoholic, pure carbonic acid gas is given off without the least trace of hydrogen. But in every case the fermentation is not simple; it is accompanied by the alcoholic fermentation. The liquor preserves a sweet taste. On evaporation, no crystals are found; alcohol separates a gummy matter, elastic, which, even after repeated washings with the alcohol, retains a little sugar.

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### TREATMENT OF FROSTED CANES.

BY MR. DAVID KER.

(Continued from page 216.)

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*From the "Louisiana Sugar Bowl."*

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Returning to the point on which I touched at the close of my hasty communication last week (the treatment of frosted cane juice), I venture to assert that whilst the polariscope is a god-send to the manufacturer of sugar, it will not tell him how to make good sugar, or how to *make most* of that proportion of crystallizable sugar which that instrument declares to exist in his raw material. I would respectfully suggest, too, that the manufacture of sugar from *raw juice* is a very different thing from the process of *refining* sugar already made. In the first operation, as conducted in nine out of ten of the sugar-houses of this State, in open kettles, we have to rid our raw material of antagonistic elements before we attain *syrup*;

and we can go no farther than *very weak* syrup in our efforts to cleanse it of foreign matter before *hurrying* it to the granulating point. Take the word of an old soldier for it, that the campaign is over, so far as the *quality* (colour and firmness) of sugar made by the old open kettles is concerned, when your cane juice has reached a density of 20°. You may skim a *little* more dirt from the surface of it, but you cannot afford to loose juice of that density, and you increase the difficulty in working that which is to follow if you mix dirt, held in solution at that density, with raw juice or juice of much less density. Settling tanks for syrup and strike-pan give an intermediate point at which, by precipitation, we get rid of a part of the heavy dirt and colouring matter which imperfect clarification of the raw juice had left. Anything beyond this is a step in the direction of *refining*, which the small planter cannot afford, and which the *large* planter cannot bring to *perfection* without the aid of bone-black, which is a mechanical and chemical filter requiring plenty of room and care. But in *no* process *continuous* from the *mill* to the *drying-room* is the *quality* of sugar materially improved if approximate perfection be not attained in the handling of the *raw juice*. It must be properly treated, *ab initio*, to receive proper benefit from subsequent filtration. If we have omitted anything in the early stages of our work, and are still determined to make fancy sugar, we must do as the refiner does, *undo* by reducing to as near the original state as possible, and treat the matter so reduced with chemicals, some of which make promises of *sweet* to the *eye*, and bring *sour* to the *stomachs* of *consumers*. But what have we producers to do with *consumers*? Let us not *poison* all the *consumers* for our own sakes!

I think I have seen in cane juice that condition of things in which the polariscope might make mistakes, or, to put the idea in other words, such *mixture* of things as to make it difficult for the polariscope to declare definitely the *proportion* of things. This is the exact condition sometimes of very ripe cane when grown in certain ("fatty") soils of this neighbourhood; and more than one sugar-maker has been heard to say, "I wish that cane had not been quite so ripe." In such cases the crystallizable portion of the juice was so

enveloped or so blended with albuminous matter and dirt as to be very difficult of separation, and the very density of the mass, as compared with a fluid of less density, operated against such ready separation of the ingredients as the sugar-maker desires.

More than 20 years ago, handling then none but green cane from virgin soil, I discovered the fact that lime in a certain quantity (then almost uniformly applied in a given *stereotyped* quantity) had no effect upon the juice, and that any considerable increase of that quantity brought "a peck of troubles," making things so far worse as to result in anything but *granulated sugar*. *Decreasing the standard minimum* I succeeded better, and still was "not happy," for when I used *next to no lime at all* I made a *little* poor sugar and *lots of molasses*, which I couldn't give away. Fairly at my wits' end I almost concluded that my juice needed *vinegar* rather than lime. I tried a gallon or two of sour apple-juice, got a better clarification, and thought I had just hit the mark; but (bless me!) how the stuff *did pull* after it began to cool! At 3 a.m. one night, when my stirring paddle was stuck hard and fast in the contents of a cooler, I soliloquized about thus: "I have tried lime by itself in every quantity, from one cubic inch to 500, and that made nothing but *dirty gum*; now I have tried acid by itself, and that makes only bright, *clean-looking gum*. What shall I do? Suppose I give her a big dose of acid first, which seems to work well up to a certain point, and then administer a dose of lime." I did it, and have been, so to speak, making good sugar ever since. Since then I have heartily thanked those who, in supplying me with sulphurous acid gas, furnished the cheap *acid* I so much sought, and gave me a *different* acid, and better than that which had brought my crude experiments to so happy a conclusion; and the sugar planters everywhere have reason to hail, as a priceless boon, the means invented for placing the fumes of sulphur within their grasp. Why? Why is it that cane juice, which contains, as every other plant does, more or less of organic acid (carrying within itself its own destroyer) is longer preserved from actual fermentation and decomposition *after* being thoroughly impregnated by *another* acid? We all know this to be a fact; all know that since we began the use of sulphur fumes

we can hold cane juice exposed to the atmosphere for hours longer than we did or could have done without this agent, and yet, in using the fumes, we throw in our cane juice an acid of *very great strength*, and *very corrosive*.

The original acid of the cane, vegetable acetic acid, not counteracted, rapidly produces fungi, which silicic acid holds in check, if it does not destroy it. It does not *destroy* it immediately, but supplants it temporarily; and does act directly upon that matter in which the *saccharine* is *enveloped*, causing it, so to speak, to *free* the sugar. This operation is assisted at the proper moment by the judicious use of lime, which, acting chemically and mechanically in conjunction with heat (a *mechanical agitator*), separates the several matters held in solution in cane juice, and places them (albuminous gum and gummy dirt) where the hand of man can reach them. But be careful as to what you do, *especially* with *frosted* juice, when you put your hand into the lime box. A small horse can't pull a ten-ton load out of the mud *all at once*, but divide that load, and give him *several* pulls, and he will, in a short time, put the whole ten tons on *terra firma*: nor will you, because morphine soothes pain, take an ounce of it; nor will you call upon the *strongest* man present to change the position in its bed of a sick infant; and surely you will not knock your house down when it will be half built. You will do just so foolish a thing when you put *all* your lime *at once* into sick cane juice before your acid had completed its mission. You might as well give yourself a dose of oil, and follow it immediately with a full dose of morphine. Why not let your acid *continue* to do its share of the work whilst a *part* of your lime is *collecting* and *coagulating* in the wake of the acid? But be sure that you put in lime enough *before* you are done, *remembering well*, however, that acid (acid gas) *evaporates* with heat (and without heat, for that matter), whilst *lime* does not. What you *aim* to do is to *come out*, at the end, with a *neutral* composition, in which neither acid nor base will predominate; aim at this, and then *do it*.

What, you will ask, has all this to do with *frosted cane* in *particular*? I want you to know first how to make good sugar from *sound cane*; and having tried to impress upon you, *by many words*,

a principle which applies to all cane juice, I have only to tell you that you *must not hurry frosted juice, except to get it through your mill*. Hasten, with all your might, to get it to where your sulphur can get hold of it, and then take your time. Be sure that you get sulphurous acid gas into it *somehow*, which you *don't* do sometimes, when you *think* you do. The only *sure* way of doing it is to *force* it in, as Communé and Randon do; and do not forget that the more your juice has been soured by frost the more it will *resist* a second acid. If you *sneeze* and *cough* much whilst you are working frozen cane juice you may guess that it is because the fumes which you are *trying* to get into your *sugar* are going into your *nose* and *lungs*. If you want to *know* where it is going to, ask your litmus paper to tell you how much has gone into your juice. Look at your juice; if it is opaque and filmy "it has *not* got the sulphur," and the reason is the *mucilaginous casing* in which the sweet and dirt are held has resisted your sulphurous acid gas. If, seeing this, you cannot increase your draft, and thereby use *more force* in your sulphur machine, kick that machine out and send for a Communé, which *forces* your fumes by *steam*, or for a Randon, which will draw them by the vacuum created by steam. For any other condition of cane than that here represented I would prefer any machine which *did not* inject by steam, because I do not like to "fool with" the *temperature* of the material I have in hand until I get ready to raise that temperature to the *boiling* point. But as my first object of *vital importance* is to get my fumes into my juice, I will select that instrument which will *most surely* accomplish *that* object at *all* times and under *all conditions*. Having secured that object, I have *patience* until I shall have given my stuff its *last paddling* in the cooler. You have a good deal to do with it *in the cooler* if you are making *string sugar*, and in the *pan* if you are refining. If you can make *syrup* you can make *sugar*. Syrup from cane juice is not *syrup* if at 25° and 30° Beaumé it does not contain *crystallizable sugar*.

Now, I should like to say something more definite about *boiling* frosted cane juice, but am admonished to bring this scribbling to a close for to-day. Before closing I will state a fact, and ask you to tell me why it is so. Cane juice untouched by fumes



of sulphur, left to ferment, makes as perfect vinegar for table use as any one could ask; whereas cane juice once impregnated with sulphurous acid gas *cannot be turned to vinegar*. Why is this?

And now for a *conclusion* to be drawn from my two papers on treatment of frosted cane and frosted cane juice. One of those letters says *windrow*, and "if 'twere well to be done 'twere well to be done" with *panis*, and in such way as to secure the greatest protection possible to all parts of the cane; the other says—get sulphurous acid gas into your juice so soon as possible, and be *sure* that you *do* get it there, when you are *trying* to do it; and both those letters conclude that the two things, urged to be done, having been *properly* done, the fight is virtually over. Up to that point much of your success depends upon efficient manual and mechanical labour. After that, upon your skill in detecting the exact condition, chemically viewed, of the material before you will depend your success or failure.

The wisest chemist, with all his knowledge, is *very* careful not to go *too fast* in the simplest experiments with *organic* matter, and knows how nice a point that is in many of his labours, at which he *must* stop or *spoil* the *conclusion*. Why may not we bunglers imitate him? I say we *must* imitate every act which *he* would perform, if the problem before him were simply to discover how much of base, or alkali, is necessary to absorb an unknown quantity of acid pervading any given quantity. Watch him. If it be a question of relative strength of *two acids*, will he apply to each, off-hand, that quantity of alkali which he knows will be saturated by a *third* acid of known strength? No; he will give to each of the acids, under trial, *small doses* of alkali taken from a *known* quantity of *known strength*, and continue this process cautiously until each of the acids will have absorbed *just* that quantity of alkali which it can saturate. In the process of precipitating, by action of any base upon its solvent, he knows full well that careless addition of one agent or the other will stop his work, may be, *spoil* the *crystals already precipitated*; yet we undertake to give a bath of acid to a heterogeneous mass, and then, not knowing how much acid has been imparted to that mass, go to

flinging caustic alkali into it in a "happy-go-lucky" style, and find ourselves unable to tell "what *is* the matter with the stuff." If the stuff is green as grass in colour, and boils in the kettle like quicksilver, we *conclude* that we had too much lime in it. Yes, we had too much in it, long before old Si, the grandsman, put that last bucketful in. Old Si, 45 years ago, had a pair of good eyes, and could see now and then, when the steam would let *anybody* see, whether he was getting *some* dirt from the surface of his juice or whether *all* the dirt had "*stayed in the juice.*" But old Si can't to-day see *anything* five feet from his nose, and yet we keep him for clarifying our juice, because he is cheap and too old for anything else, and because it is traditional on the plantation that old Si, 50 years ago, could make as good sugar as "ary 'nother man." Everybody knows that, when old Si saw one day "that the juice don't look like it did yesterday," he "went right straight to the lime barrel, and got a blue bucket full of lime and put it in his juice;" and I can't get the very oldest inhabitant to describe to me the *exact* effect of that *last* bucketful, but I can *guess*, for I have *seen* it done by *younger* men than *old Si*. Lime, or something possessing its properties, is a very good thing, an absolute necessity in our manufacture of sugar; but why use too much of it?

Some chemist, writing from St. Louis about the manufacture of sugar, has given the planters a key to success in that line by writing a single sentence. He says that "Louisiana cane juice requires to be worked a little acid." Having *known* this for 25 years past I *specially avoid the over free* use of lime; and though I venture to say that no man uses more of it than I do, I do most carefully abstain from *such* use of it as would, at the end of my *boiling* and *cooling*, leave any perceptible preponderance of *lime* in my sugar.

Nine sugar-makers out of ten seem to think that the greener the cane (and, consequently, the weaker the juice) the more lime they require; whereas long experience teaches me that I must be specially careful how I use lime in *such* juice. Then *particularly* I want to know the exact strength of my lime, and *never* use anything but the hydrate of lime. The sugar-maker who would, in handling *any* juice, and especially weak juice, hustle together a half-bucket of

lime, carelessly slacked, and a half-bucket of juice, and pitch them into my clarifier, wouldn't pitch the *second* one in my establishment, for two reasons: no two bucket-fuls of *dry*\* lime, though taken from the same lime barrel, have *exactly* the same strength (are *equally slacked*), and therefore the operator is working somewhat at hap-hazard in using *any* given *bulk* of it. Secondly, I would not permit any man to *destroy* a half bucket of my cane juice, as he *would* do *every* time he would mix that quantity of juice with even *one-tenth* of raw lime. Mr. Editor, do you "see the *pint*," after so much talk of *bucketsful* of lime? I mean simply (but may have hard luck in expressing it) that until my juice shall weigh, say 15°, I can *add* as much lime as I may think I need; but if I shall have put the least bit *too much* I can not take it away at *any* stage of the game. If I get the very *least bit* too much lime, I have to *sweat*, to pay for it, in what I call the *building-up process*, which (in string sugar) involves special care in *boiling* and *mixing*, and *then* the *planter* is none the *gainer*. If the *colour* were all, I could remedy *that*, but quantity and quality are involved.

All this applies to the handling of *any* juice by any finishing process, but peculiarly so to that condition of juice which we get from *frosted* cane. The more sour your juice the greater the danger from *too early* and *too free* use of lime, for just so surely as you *abruptly* kill *that acid* before you will have removed the *bulk* of *foreign* matter, *just so surely* will you *destroy* the *sweet*. There is an obvious reason for this. The violent attack of acid and alkali upon each other does the business, *consuming*, as it were, more or less of the saccharine principle, and converting it into glucose or grape sugar. This glucose, blended with the gum and earthy matter which you *should* have *first* removed from your cane juice, hinders the crystallization of the saccharine, and the more you *boil* it the less *sugar* you will get. Indeed (and herein lies a truth which you must not forget) *badly frosted cane juice* can *never* be *boiled* to the point, or to the same degree Fahrenheit, to which sound juice is

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\* Slacked lime is hydrate of lime, but I use *paste* of lime, to be more sure of getting *hydrate*.

carried, without being carried *beyond* the point of *crystallization*, simply because the point at which glucose and saccharine can be *separated* is short of the *granulating* point. In other words, at the same degree of heat at which sound juice, rid of impurities, will granulate freely your sick juice, full of impurities, will be so incorporated with those impurities as to be ever after inseparable. The exact point at which you cease to boil—at which to withdraw from the *fire*, and leave the rest to the *cooking* process—is reached by only the practised eye of the experienced boiler, and yet is so well fixed as to *warn* you, before you reach 238° Fahrenheit. Hence I said you must know “when and how to *boil*.”

Let me make a short *résumé* of this and the two preceding papers, and I am done. I have declared my faith in the efficacy of windrow, and have stated *facts*, which have occurred within the range of my long experience, on which my faith is founded. These are facts easily substantiated by living witnesses of the circumstances referred to. Saying nothing of those *local* and partial freezes which killed and soured cane in *one spot* and did *not* seriously affect cane of adjacent localities, I have given you my experience in 1858, 1876, and 1877, when the cane, all over the State, was so terribly injured. If good sugar, in large quantity, was made on the 19th day of January, 1859, from cane which was put in windrow on the 8th of November, 1858, after having been *thoroughly* frozen, and that, too, when the interim between those dates was signalized by such a spell of sultry, rainy weather, as the oldest inhabitant has never seen before or since—if, on the 10th day of January, 1877, I made prime sugar from cane windrowed early in November, 1876, and that after such a protracted *drought* and variation of temperature as characterised that season—and if, on the 25th day of January, 1878, perfect sugars were made from cane which I windrowed on the 30th November, 1877 (the last of which cane was *milled* on the afternoon of January 21st), and *that* after *frequent rains* had interrupted hauling—if such be facts, may I not be pardoned for *positive* expressions of the faith that is in me—faith in windrow? If cane, which had been frozen *solid*, made *good* sugar in large quantity, *seventy* days after being put in windrow (as in

1858-59), and if cane put up for seed in October has been known (not unfrequently) to make sugar in the following March, do I go too far in asserting my belief that cane properly windrowed will make sugar after ninety days? Bearing in mind that I have coupled this assertion with the condition that you windrow before the mercury shall have indicated a temperature of 50° (an average for the 24 hours), and that I inculcate painstaking against wind and water, I have nothing to recant on that head until I shall have seen something which I have never seen during twenty-seven years of studious observation and actual handling of the subject.

My second paper embraces too wide a field to be disposed of in a short *résumé*, but means—get sulphurous acid gas—or any thing else which produces the same effect—into your sugar. If you cannot get that into your sugar some how, get it there any how.

My third and last says, simply, do not work against yourself, with old Si's traditional blue bucket-ful of lime. In fact, it says, send old Si to his cabin, to die on his laurels, and make young Si lime your clarifier under some one's intelligent directions. See to it that young Si is wide awake and quick in his motions, for he is determining, in his clarifier, the quality of your sugar. Then watch your sugar-maker's boiling point, and if what he shows you in the cooler, after having been properly treated in the clarifier, pulls "much to speak of," or, after leaving the vacuum pan, hangs fire in your centrifugals, respectfully suggest to him that his sugar might have been over-boiled. Don't say any more, for some tip-top sugar-makers will get mad if you speak as if you know anything about your own business.

Some rainy day, when I can't do anything else, I want to talk to you on another branch of the subject—the cultivation of the cane. Don't ask me what has that to do with the subject, for I might write another column to show you that there are fixed rules and principles in cultivation of cane. Adios,

Yours, DAVID KER, Manager.

(To be continued.)

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## AMERICAN CENTRAL SUGAR FACTORIES.\*

BY M. A. MONTEJO, C.E.

*(Continued from page 200.)*

It is unfortunately true, that the sugar industry has yet technical deficiencies of great importance; as long as it does not succeed in extracting economically all the sugar, which the prime material contains; as long as it does not succeed in transforming the juice obtained into sugar and water for its purer and easier concentration, it will, always be moving in a vicious circle, which it can only partially leave with the help of great skill in the *modus operandi*, and, above all, by the abundance of the raw material, which allows a large enough margin to counterbalance the losses, which an imperfect fabrication consequently produces.

The means of operating on cane juice, now in use, differ principally in the methods of evaporating, which consist of *open kettles*, *steam pan*, *triple effet* and *Concretor*. The first named has nothing to recommend it except its simplicity, but it produces an undue proportion of molasses, on account of the high temperature to which the cane juice must be submitted. The *steam-pan* often consumes too great a quantity of fuel, on account of the indirect action of the heat, and by reason of the frequent useless condensation, consequent irregularity of labour. The *triple-effet* method causes a notable economy of fuel, but the intricacy and slowness of its operation, coupled with the necessity of using bone black in connection with it, are serious drawbacks to this system of evaporating at low temperature. The *Concretor* is an apparatus of great simplicity, allowing an extensive evaporating surface, without any danger to the juice, and concentrating it into syrups at 25° to 30° Beaumé. These apparatuses, used in connection with the *vacuum pan*, can give an average yield of 5½ to 6 per cent. for *open-kettle*, 8 for *triple-effet*, and 9 for the *Concretor*.

\* It is hardly necessary to say that this paper was written with express reference to the present condition of Louisiana, but it will be found equally applicable to other Countries similarly circumstanced.

Let us now enter into an examination of the financial features of the "Central Factory" system. It is notorious that the number of abandoned sugar plantations is on the increase; as a consequence, the machinery of the sugar houses and other appliances, are going to ruin, ditches are filling up, and the fields are covered with dense masses of weeds. These plantations are, therefore, property of negative value in the hands of their owners; they cost heavy taxes yearly and yield nothing in return. Now, if these lands were divided into small farms of from 100 to 300 or even 600 acres, these could be rented out, and their cultivation into cane stimulated by the erection of central sugar factories, with powerful and improved appliances, where the farmers could always find a purchaser for his product. These lands would then acquire value, and yield a revenue instead of being a burden. In cases where farmers should become owners of their land, they could be interested as co-partners in the factory, and this sort of co-operative association has already been tested in the Zollverein (Germany), where each shareholder of a factory is obliged to furnish a given proportion of beets yearly.

These abandoned lands, then, would be divided and rented, say for ten years, giving the tenant the privilege of becoming owner during that period; the payment of the rent of the purchase price could be made payable in good, sound cane, at a rate to be agreed upon, with the obligation upon the tenant of reserving for the factory the whole of his production of cane. Of course it devolves upon the managers of the factory to encourage the cultivation of these farms by all proper means, such as introducing improved means of transportation, as in the French West India Islands, through the use of tug-boats and the construction of tramways, by furnishing advances for fertilizers, by facilitating the means of draining and irrigating the lands, by furnishing agricultural implements, and even, when circumstances justify it, steam ploughs. The river and bayou lands, on account of their being almost level, and of their shape in the area of cultivation, could have cheap and improved means of transportation built.

It is an undeniable and deplorable fact that labour, when in

demand, and especially when it is transient, is unreliable; but lately it has been in better supply, and at reduced wages; and it is no less undeniable, that where the labourer is ambitious of securing a permanent home, and of providing for his future comfort and that of his family, he becomes a powerful ally of capital, which enables him to attain these ends, and can easily be controlled. Unfortunately, capital, which in periods of prosperity is so prone to run into rash ventures, is known by experience to timidly seek a hiding place, and disappear when a reaction comes,—there to remain in an inactivity,—disastrous alike to itself and the country. Some of the results of the erection of central factories would be to call out this dormant capital, to give value and life to productive property, to awaken a speculative spirit in business men, and guide labour in the way of intelligent economy. Introducing the central factory system would also result in a separation of the three branches of the sugar trade, the agricultural, the manufacturing, and purely commercial interests, and would certainly give rise to numerous commercial transactions on short credit; and our banks and institutions of credit, whose vaults are now overflowing with funds, for which no advantageous employment can be found, would have a new line of safe and remunerative business, whilst they would strengthen labour, facilitate transactions, and stimulate production,—their legitimate objects. The administrators of the factories could invite small labouring capitalists to become tenants, owners of lands, or even shareholders in the Association, a practical mode of disposing of lands. Contracts would have to be entered into with neighbouring planters for the purchase of cane, deliverable at various times—an important resource to cover whatever deficits might arise in the production of tenants.

As regards current advances, it were better to leave them to outside parties, and here speculators would find a wide and profitable field, in coming to the aid of the enterprise. If, by previous contracts, the cane of the tenants or neighbouring planters, with a mean density of 8° Beaumé, was bought at the rate of 3.50 dols. to 3.75 dols. per ton, and if, under the same conditions, parties could be found, able and willing, to undertake to furnish, say 3000



tons, the price could be raised to 4 dols; if 6000 tons, to 4.50 dols. Thus, the maker of the advances would have the advantage of a two-fold negotiation, and the factory never fear a lack of supply. Of course, it is desirable that the manager should be entrusted with discretionary power for exemptional cases of this kind.

It now remains to consider what kind of persons it will be best for the factory to choose as tenants. There are a large number of individuals who, as overseers or managers for others, have acquired enough means to be tempted to carry on the planting business on their own account. It is true that many of these, from having undertaken too heavy a task, have seen their efforts end in failure, but as tenants or farmers they would undoubtedly have achieved success. Owing to their experience and accumulated earnings, this class of persons would undoubtedly be the most reliable of all tenants. Immigrants, also, who have previously been accustomed to tillage of the soil, can easily be made conversant with the speciality of cane culture, and become very good tenants. The coloured man is a labourer of the first class, on account of his endurance and sobriety; but by nature he is deficient in self-reliance, in ambition, and in thrift. He views labour not as a struggle in which he must strive to achieve victory, but as a necessity that cannot be avoided. These reasons may account for the poor results that have attended planting on shares, where attempted with this class of labourers; but the parishes of Lafourche, St. James, and the Attakapas, where this system of planting has been extensively practised, chiefly with white labourers, could furnish a large number of men accustomed to the share system (which is only a crude form of the central factory system), and who should be glad to become tenants.

For a first local attempt we would suggest the erection of a central sugar factory with a capacity of 20,000 hogsheads of sugar, to be made in 100 days of 10 hours of labour each; and the apparatus, &c., and estimates could be assimilated to those of the "Simon" factory, in Martinique, which is about the same size. The "Simon" is of brick and iron, and forms a square, the sides of which measure 110ft., the cost of the structure amounting to 13,000 dols. It contains a sugar mill capable of grinding 130 tons of cane in 10

hours, four defecators, one *triple effet* evaporating apparatus, two vacuum pans 2 metres by 1.40 metre, ten centrifugals, two boilers, one distillery, boneblack furnaces, one workshop, and a sugar warehouse. The total cost of the factory and accessories, imported from the Paris manufactory of Cail, and put up in complete working order, amounted to 130,525 dols. in gold. In addition to the above the factory owns over three miles of railroad, costing, with its rolling stock, 23,650 dols. In our projected factory, some retrenchment could be realised on the above figures by dispensing with the distillery, worth 5000 dols., and by using, instead of the *triple effet* apparatus, worth 12,000 dols., a Concretor, worth only 6000 dols., having a concentrating power of 1500lbs. syrup per hour, the Concretor being, besides, a more energetic evaporator and lesser producer of molasses of the two. By this means raw sugars could be produced suitable to the demand of trade, or which, if necessary, could be laid aside to be refined after the grinding season proper,—the factory being destined to work as a refinery after that period. We suppose the working time of the factory to be limited to 100 days for 2000 hogsheads of sugar, but, by increasing the number of working hours, the producing power could be doubled. It may be proper to add that all we have said applies with equal force to the refining of all domestic or foreign sugars.

The green bagasse could be utilised directly as fuel in conjunction with coal, and this, with the help of improved furnaces, can cause a reduction in the weight of coal to be consumed to 80 per cent. of the weight of sugar produced. The cost of the "Simon" factory, then, was 126,000 dols. gold, or say 150,000 dols. of our currency, to which must be added a further amount of 50,000 dols. for the value of the land, the improvement of roads and other means of communication, making a total of 200,000 dols., which we may assume would be the cost of a similar factory to be erected here by a company. This sum could be obtained either by the ordinary mode of subscription or borrowed under conditions to be provided by the charter of the company. Let, for instance, five of our banking institutions undertake each 20 shares, or one-half of the capital stock. With such a start, it can hardly be doubted that the balance

would be promptly taken up by the public. Another mode would be, if security can be furnished, to borrow the 200,000 dols. for five years, the shareholders holding themselves liable both for the amount of their shares and the interest on the debt up to the time when, the factory being in full operation, a sinking fund can be created out of its earnings for the extinguishment of the debt. It is needless to go at present into greater particulars, the solution of such questions appertaining to the stockholders themselves. We would suggest, however, the insertion of the following articles into the charter of the new company:—

“The capital of the company shall be 1,000,000 dols.; but the company will be constituted and commence operations as soon as 200,000 dols., or one-fifth of the amount of each share, shall have been paid in, and the balance shall be payable as required by the managers for the equipment of the first ‘Central Sugar Factory.’

“The first issue of 200,000 dols. shall be made in 200 shares of 1000 dols. each, and each share, when fully paid, shall bear an interest of 8 per cent., to be paid out of the earnings of the factory. The manager is fully authorised to make all purchases of machinery, apparatus, land, &c.; and to engage *employés* and discharge them; to make all contracts relative to the carrying on of the factory, subject to the approval of a board of supervisors, whose duty it will be to take cognizance of all operations, and to report thereon in general meeting of stockholders.”

Regarding the location of the factory, the most eligible will be any point affording easy access to the raw material, and offering the most convenient and rapid means of transportation. The parishes of Iberville, Ascension, St. James, and Plaquemines, for instance, could be properly selected for the erection of factories furnished with only a Concretor apparatus; whilst the neighbourhood of New Orleans, and the parishes of Lafourche and St. Mary would offer more appropriate sites for refining factories.

It is clear that the portion of the capital laid out in the erection of a factory would be secured not only by the factory itself, but also by the value and revenue of the adjoining lands as soon as they are under cultivation. A sugar factory conducted on this system,

leaving to other parties to produce the cane on their own responsibility, must make it a special duty to improve the yield in quantity and quality, as the demands of the market may dictate, and to regulate its operations in such a manner as to take the utmost advantage of the short duration of the grinding season by avoiding all interruptions, whether through the lack of cane or any other cause. Let it be borne in mind that it is only by thoroughly combining all the details of the factory into a harmonious whole that an undertaking of this sort can be made successful; and as the means of communication have direct control of the produce of the country through which it runs, for this reason it is important that a Central Factory may provide, when necessary, the facilities of transportation for all its raw material.

It is a general law that whenever a new enterprise, backed by capital, is established in a community, calling to its aid the labour of the country, and striving to enlarge its field of action by a judicious use of credit, commercial transactions are developed which attract money and create wealth and prosperity.

We believe that the brightest hopes of the local sugar interest, of the whole commercial community as well as of the owners of the rural property, will be realised by the division of landed estates into farms and by the erection of Central Factories (either for the manufacture of sugar or any other product), judiciously located and intelligently managed. When this takes place there must be an incessant influx of useful, energetic immigrants in search of a comfortable livelihood, which their labour will be sure to earn for them here. And if the valuable products of the West, as well as of the South, are to find a natural outlet by the Mississippi River as soon as a sufficient depth of water has been obtained at its mouth, Lower Louisiana must be able to pay for these products with those of her own soil; and as sugar is in constant and increasing demand, she could complete her inland commerce by a return freight, directing her efforts towards raising her production to a level with the national consumption. We claim that some of these efforts should result in the erection of "Central Sugar Factories," firmly convinced that they will ensure success.

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## THE COLONIAL SUGAR REFINING COMPANY'S NEW WORKS, PYRMONT.

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The following account of the progress of Sugar *Refining* in Queensland will have an interest for many of our readers :—

The extension of the operations of the Colonial Sugar Refining Company is but another instance of the rapid development which all our industries are undergoing at the present time. Perhaps, however, no industry has had to experience the difficulties which surrounded this undertaking, and that it has been fully established on a firm and profitable basis, without fictitious or artificial support in the way of protection, is creditable to the foresight and energy of its founders. The extensiveness of the business of the company at the present time may be judged from the stupendous character of the new works. They stand on the shore of Elizabeth Bay, at the head of Johnston's Bay, on what was formerly known as Chowner's Point. Recently this was a barren spot, but this magnificent structure changes the appearance of the locality entirely. The site has been chosen with good judgment, as, with its deep water frontage, ample facilities are afforded for the discharging of vessels of the largest tonnage, almost at the door of the works. Two jetties extend out from the base of the works, and the sugar to be refined is removed with ease from the vessel's side to the store, which is capable of holding 8000 tons, and which, as a precaution against fire, is divided in two by a thick stone wall. From this store the raw material will be raised by a lift (worked by powerful hydraulic machinery manufactured by Sir William Armstrong and Co.) to the top of the main building or refinery proper. This building contains nine floors, and is a splendid specimen of architecture in design and construction. The roof, so to speak, consists of an iron tank 57ft. by 57 by 4 ft. capable of holding 80,000 gallons of water, which is, of course, fresh and available for the purposes of the factory, or for putting out fire ; but for this latter purpose it is not likely ever to be used, as the building is as nearly fireproof as it is possible to make it. The walls are extra

thick, of stone and brick; the massive hardwood beams are supported by iron pillars, while the floors are of wrought iron and are laid on iron joists; even the stair-cases and window-sashes are of iron, so that there is really nothing to burn. The raw sugar having arrived on the uppermost floor, is taken from the packages, and, passing through trap doors, is emptied into circular vessels on the No. 8 floor, where it is melted in water to a given density, the operation being expedited by the aid of steam and a mechanical stirrer, worked by steam. The liquid sugar is then run through a trough to the head of the bag-filters, which occupy floor No. 7. These are cisterns containing many long cotton bags, each protected by a sheath, and the liquid filters through them, leaving behind any sand, dirt, or other insoluble matter it may contain. Liquid sugar easily acquires colour, and it is therefore the object of the refiner to evaporate it at as low a heat as possible. This is the reason vacuum pans are used—the air is exhausted by means of an air pump—the liquid sugar is forced in by the weight of the atmosphere; steam is turned on by degrees, and nearly the whole of the water is evaporated at a temperature of  $140^{\circ}$  to  $145^{\circ}$  Fahrenheit, whereas, if it was boiled in the open air, a temperature of  $212^{\circ}$  would be necessary. The water, as evaporated, becomes steam, and is immediately condensed in a vessel connected with the vacuum pan, drawn away by the air-pumps, and run off through a Torricellian tube—which is an ingenious contrivance for making the atmosphere aid the air pump in maintaining a vacuum. While the water is being evaporated the sugar crystals are forming again, and can be made large or small at the boiler's pleasure. On floors No. 4 and 5 the clarifying process by the aid of charcoal, certainly the most complete and effective ever introduced to this colony, is carried on. The vacuum pan, to be now seen at Pymont, is the largest in this colony, and holds a charge of at least 25 tons, which it can treat in from three to four hours, according to the quality of the material. It is of burnished copper, and was built by J. Shears & Son, England. At the bottom of this pan, and descending into floor No. 3, is a discharge hole, and, immediately under it, a cooler (of iron),

of equal capacity with the pan. When the boiling is over the cooked mass is let down into this cooler, where it is well mixed by another mechanical stirrer, until the whole has been drawn off, and treated in the centrifugal machines, which are situate on floor No. 2. These machines are circular buckets, made of brass and copper, perforated with very fine holes, and revolving on a central spindle at great speed—600 to 1200 revolutions per minute. The effect of this motion is to drive the *masse cuite* against the side of the revolving basket, and to force through the perforations all the liquor which remained in it. A minute or two, and the machine is stopped, and the sugar appears a solid lining to the basket, but it is easily broken down by a wooden spaddle, and it is at once fit for use—as white as snow, in bright sparkling crystals—or with a delicate primrose hue, as the tastes of customers may require.

In the bottom of each basket are lids, which lift up, and through them the sugar is emptied into waggons waiting below, to be conveyed to the foot of a lift, which rises it to the top of the refined sugar store, where it is shot through holes into various bins, according to quality. There it is allowed to cool, and is frequently turned over to keep it from caking and to get rid of any moisture. Thence it is shot through hoppers into bags, which, when filled, are weighed, marked, and stored away on the next floor, ready for delivery to the grocers or for shipment to other markets.

No fire heat is used, except in the char burning—steam does everything; it is generated in five large boilers, with flues leading to a chimney 150 feet high. in these flues is an apparatus called an “economiser,” for using up any heat that may not otherwise have been utilised. Water, for condensing, is drawn from the harbour. Fresh water is obtained from a well, 120 feet deep, connected with a bore, 4 inches diameter, which descends nearly 300 feet more; a powerful pump raises the water to the tank, before referred to, on the top of the refinery. So far the well supplies regularly about 50,000 gallons per diem. Underneath the refined sugar store is the engineer’s shop, filled with lathes and other labour-saving machines. On one side of it are being erected the offices for the manager, the clerks, and the officers of excise;

the latter are necessary, as the business is carried on in bond. This refinery is arranged to turn out 400 tons of sugar every week, but with very trifling additions it is equal to a work of 600 tons.

It has been designed and erected under the immediate supervision of Mr. Frederick Poolman, formerly manager of the Sandridge Works, Melbourne, and now the consulting engineer of the Sugar Company, after an inspection of the various refineries in England and Scotland, as well as in Europe, and it contains all modern improvements of value. Much of the superintendence of details has devolved upon Mr. Muir, and he appears to have done his work faithfully and well.

The cost of this large manufactory has been £120,000.

The Colonial Sugar Refining Company was established in 1855, and besides the above works, possesses its sugar house in Parramatta-street, where they worked for many years until the growth of the city rendered removal desirable. It has also erected, on the Clarence River, three large double mills for the manufacture of sugar from cane grown by the farmers, and is arranging for a further extension of its enterprise to the Tweed River.

The Company finds employment in its ordinary business, during the sugar season, at the Clarence for about 700 men, and pays in wages alone over £50,000 a year.

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#### MESSRS. BOOTH AND EDGAR.

*(From the American Grocer of April 4th.)*

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The failure of these well-known sugar refiners, on Monday last, took everybody by surprise, as they were one of the oldest and best-known firms in the trade, and hitherto have been considered one of the strongest, financially. It is understood that it was caused by the very large depreciation in the price of sugar during the past year, and to the smaller, but steady losses, which have been caused by excessive competition between refiners, which has cut down the margin between the raw and refined article to a point where the business yields a loss instead of a profit.



The firm is composed at the present time of Mr. William A. Booth, Mr. W. T. Booth (his son), and Mr. J. H. Peters; the other senior member, Mr. Edgar, having died some years ago. This failure has not been the result of either rash speculation or extravagant living; and the greatest sympathy is everywhere expressed for the firm, both by its creditors and the business public generally. Indeed, it may be said that there is hardly a man among the merchants of New York who is so universally respected and esteemed as Mr. William A. Booth. During a long life he has devoted a large portion of his time and means to doing good. He is at this time president of the "Children's Aid Society," and prominently connected with several other charitable institutions. We understand that the firm is likely to pay in full, unless the depreciation upon their refinery, in the event of their stopping permanently, should be larger than is expected.

This is the second failure of the firm—the first having occurred many years ago (in 1838, we believe), the creditors allowing them to go on upon their own terms, and a few years afterward they were invited by the firm to a dinner, when, under each man's plate, was found a check for the full amount which the firm owed him, with interest. It is probable the creditors will pursue much the same course at the present time, one of the principal creditors having remarked "that they certainly could not select, from their own number, a trustee who would look after their interests with more fidelity, or ability, than Mr. William A. Booth."

We have, in our columns, noticed several prominent citizens under the name of "The Good Men of New York," but we have strangely omitted one of the most prominent of these in the person of Mr. Booth. We are gratified, at this time, to be able to pay a deserved tribute to his worth, and venture to express the hope that we shall have the opportunity, for many years, to hold up his long and useful life as an example for "our boys."

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Government advices, received from Havana to April 11th, state that the total number of insurgents who have submitted to the authorities consists of 11 generals, 127 superior officers, and 5877 men. There were not any insurgents left in the eastern department. The basis of peace have been accepted by all the insurgents, excepting the negroes under the orders of Senores Mace and Vincent Garcia.

## ANALYSES OF CANE AND BEETROOT SUGAR ASH.

By J. W. MACDONALD.

*(From the Chemical News.)*

The *Chemical News*, vol. xxxvii., p. 76, contains an analysis of Demerara sugar ash, by Dr. Wallace, which is very interesting. Perhaps the following may also be of interest, especially to those of your readers connected with Messrs. Duncan & Newland's alum process.

The samples were obtained by preserving the ashes of *all* cane and beet sugars, analysed in the laboratory of a large sugar refinery, during one year. The analyses may therefore be taken as representing the average composition as regards bases, phosphoric and carbonic anhydrides and chlorine having been displaced by the sulphuric acid employed in the sugar analyses.

It will be noticed that cane ash contains a larger proportion of lime, magnesia, ferric oxide, and sand than beet. These substances are removed from the juices in the beet manufactories, but, in the West Indies and cane-producing countries, the manufacture of sugar has not yet reached such a perfect state.

	Cane Ash.	Beet Ash.
Potash .....	28.79	34.19
Soda .....	0.87	11.12
Lime .....	8.63	3.60
Magnesia .....	2.73	0.16
Ferric oxide and alumina .....	6.90	0.28
Sulphuric anhydride .....	43.65	48.85
Sand and silica .....	8.29	1.78
	<hr/> 100.06	<hr/> 99.98

*Love Lane Refinery, Liverpool.*

Comparative Experiments on the Formation of Fructose from Sucrose and Sulphuric Acid—Fr. Anthon.—The most favourable results were obtained by boiling cane-sugar for forty-five minutes with twice its weight of water and one per cent. of sulphuric acid.—*Beidermann's Central-blatt.*

THE SUGAR BOUNTIES SYSTEM.—The Bristol operative sugar refiners, who have considerably suffered through the system of bounties granted by the French Government to importers of refined beetroot sugar, have determined to institute an agitation for the purpose of obtaining an abolition of the system. It is intended by them to obtain the co-operation of the operatives and manufacturers of refined sugar in England, and enter into communication with working-class organizations throughout France, and thus bring united pressure to bear on the French Government for the withdrawal of the bounties. About 500 men are affected in the Bristol district.

The Counterslip Sugar Refinery, Bristol, the largest of its kind in the world, has been bought by Mr. P. Worsley, of Bristol, on behalf of himself and four others, for £74,500, the vendors being the Bristol Old Bank, which held a mortgage, as creditors of Messrs. Finzel, who failed last year for about half a million. The works cost Messrs. Finzel over £400,000. It is intended to reopen them, but not on so large a scale as before, when they employed 2000 hands, and turned out 1200 tons of sugar weekly.

### MONTHLY LIST OF PATENTS.

Communicated by GEORGE DAVIES, C.E., Patent Agent, 4, St. Ann's Square, Manchester.

#### ENGLISH.

##### APPLICATIONS.

1123. HENRY RAWLINGS, of 108, St. Martin's Lane, Westminster. *Improvements in filter-presses.*

1298. EUSTACE CAREY PRENTICE, of Stowmarket, Suffolk. *Improvements in filter-presses.*

No specifications relating to sugar this month.

#### AUSTRIAN.

8. R. BERGREEN, of Roitsch, Prussia. *A press for cut beetroot.*

16. J. BOWING, of London. *A filter-press.*

17. M. BRAZDA, of Brünn. *A thermometer-guard in diffusion-apparatus of sugar-works.*

66. W. KRUMBHOLZ, of Klein Cicowitz. *A machine for hillocking beetroot.*

70. W. R. LAKE, of London. *Improvements in machines for the manufacture of sugar.*

76. MARKY, BROMOVSKY, AND SCHULZ, of Prague and Königgrätz. *A continuous apparatus for stoning beetroot in sugar-works.*

87. T. FILTER, of Paris. *Obtaining so-called artificial animal charcoal.*

90. THE PRAGUE ENGINE WORKS COMPANY. *A revolver diffusion battery for sugar-works.*

108. F. WANNIECK, of Brünn. *An osmose apparatus for sugar-works.*

57. J. J. LANGER & SONS, of Cologne. *A densoscope for determining the concentration of liquids boiling in vacuo.*

60. G. & F. LÖEWIG, of Dresden. *A process for clarifying sugar.*

81. H. PAUCKSCH, of Landsberg, Prussia. *An apparatus for washing animal charcoal.*

82. H. PAUCKSCH, of Landsberg, Prussia. *Improvements in heating furnaces for animal charcoal.*

83. W. PECHANÉK, of Prague. *A diffuser with perpendicular discharger of cut beetroot.*

108. T. TRESSAERT, of Cassel, France. *A beet-cutter.*

#### BELGIAN.

44372. A. SEYFERTH. *Apparatus for extracting sugar by lixiviating salt lime of molasses with alcohol.*

44513. H. DANCELLE. *Refining and decolouring oil, spirits, and syrup.*

44514. H. DANCELLE. *A filter-press.*

44534. A. DREVERMANN. *Extracting sugar from molasses.*

44589. A. DORZÉE, of Boussu. *A distributor of carbonic acid gas in juice, applicable to the carbonating boilers in sugar-works.*

44594. G. LE DOCTE, of Brussels. *An alkali-metrical apparatus for sugar-works.*

#### CANADIAN.

8147. <sup>2</sup>EBEN WILLIS, of Colton, N.Y., U.S. *Improvements on sap-buckets.*

#### FRENCH.

120412. MÉRYOT. *Refining raw sugar or syrup so as to obtain regular blocks without employing the decolouring process.*

120491. DERYAUX-IBLED. *Evaporating osmose juice, and water, and utilizing the waste steam.*

120550. MAUROY, of Paris. *An apparatus for removing pulp and scum from beet-juice.*

120760. ATHÉNAS, of Saint Denis. *Extracting cane sugar by using hot cane liquor, &c.*

120761. LENOIR, of Saint Denis. *A rope-way for transporting cut sugar cane to the sugar-works.*

120776. DANGRÉAUX, of Lizy-sur-Ourcq. *An apparatus for sieving the pulp of beet-juice.*

120812. LOTS & FISON. *A filter with horizontal pockets, for sugar works, refineries, glucose, and other works.*

120903. PRIEW. *Obtaining white sugar from beet pulp, by employing a hot and concentrated solution of sugar in centrifugal engines.*

120905. EVELOY. *A beet extractor.*

121065. COLOGON, of Saint Denis. *Treatment of the juice of sugar cane.*

121079. DE MOREL. *Improvements in his process of extracting sugar from cane liquor, as patented 9th October, 1876.*

121140. FLAMENT & DOUFFET, of Béthune. *A continuous beet press.*

121394. TURPIN. *A machine for cutting sugar.*

#### CERTIFICATES OF ADDITION.

114348. TISSOT. *A continuous filter press.*

115515. BONZEL. *A beet juice press.*

113520. LIEBERMANN. *Manufacturing sugar.*

115527. FRÉMAUX. *A centrifugal apparatus for clarifying sugar.*

115770. SCHWARTZ. *Manufacturing sugar.*

115515. BONZEL. *A beet press.*

118953. LECCOINTE & VILLETTE. *A preparatory press for beet pulp, &c.*

#### GERMAN.

802. F. MÖHRING, of Magdeburg. *An instrument for indicating the concentration of sugar juice whilst boiling in vacuo.*

904. F. SCHEIDLER, of Burtshied. *A sugar cutting and ranging machine.*

984. R. BERGREEN, of Roitzsch. *A process for removing gases from the cells of beetroot cuttings in osmotic operations.*

1007. WEGELIN & HUEBNER, of Halle-on-the-Saale. *A lixiviator, with a contrivance for opening, closing, and tightening the moveable filtering bottoms.*

1082. E. LANGEN, of Cologne. *Obtaining hard white sugar by means of centrifugal engines.*

#### NORWEGIAN.

3. G. A. HAGEMAN, of Copenhagen. *Improvements in the manufacture of lumpy sugar.*

### SUGAR STATISTICS—GREAT BRITAIN.

TO APRIL 20TH, 1878 AND 1877. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

	STOCKS.		IMPORTS.		DELIVERIES.	
	1878.	1877.	1878.	1877.	1878.	1877.
London . . . .	69	65	65	82	92	69
Liverpool ..	35	31	64	71	59	58
Bristol . . . .	3	2	14	14	14	14
Clyde . . . . .	53	28	88	78	75	67
Total ..	160	126	231	245	240	208
	Increase.. 34		Decrease.. 14		Increase.. 32	

STOCKS OF SUGAR IN THE CHIEF MARKETS OF THE WORLD ON THE  
1ST MARCH FOR THREE YEARS, IN THOUSANDS OF  
TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
173	156	37	81	3	450	323	456

CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING  
1ST MARCH, IN THOUSANDS OF TONS.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
879	266	26	276	165	1612	1589	1610

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE,  
FOR THE ENSUING SEASON, COMPARED WITH THAT OF THE THREE  
PREVIOUS SEASONS.

(From *Licht's Monthly Circular*.)

	1877-78.	1876-77.	1875-76.	1874-75.
	Tons.	Tons.	Tons.	Tons.
France .....	370,000 ..	243,295 ..	462,259 ..	450,877
Germany (Zollverein) ..	370,000 ..	291,204 ..	346,646 ..	250,708
Austro-Hungary ....	250,000 ..	205,267 ..	180,138 ..	140,192
Russia and Poland ..	220,000 ..	250,000 ..	245,000 ..	222,500
Belgium .....	65,000 ..	44,467 ..	79,796 ..	71,079
Holland and other Countries.....	25,000 ..	25,000 ..	30,000 ..	30,000
Total.....	<u>1,300,000</u>	<u>1,059,233</u>	<u>1,343,839</u>	<u>1,165,356</u>

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STATE AND PROSPECTS OF THE SUGAR MARKET.

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The Sugar Market during the past month has been steady, and prices are almost on a par with those of last month. The month closes with great quietness, especially in refined, and large arrivals of raw sugar at the same time have checked business. Rather lower prices would have to be accepted to effect sales. There does not appear, however, any ground for thinking the pause is more than temporary. Paris loaves, the weather glass of our market, are 9d. lower for the month, and this has its effect on the refined market, refiners being obliged to protect themselves against French protection at the expense of raw sugar producers.

The stock of sugar in the United Kingdom shows an excess over that of same period last year of 35,633 tons. At the end of last month, a similar comparison showed 58,000 tons in excess.

The deliveries continue on a larger scale than during 1877, and, on the 20th March, were about 39,500 tons in excess of those for 1877 at the same period.

The excess of imports, as compared with 1877, is decreasing; those of the two years being now almost on a par.

If deliveries continue on the scale they have done so far this year, they must importantly modify the statistics before long.

Advices from Cuba are very unfavourable, and the crop must be small and late.

Present quotations of the standard qualities are as under:—  
Porto-Rico fair to good refining, 21s. 6d. to 22s., against 21s. to 21s. 6d.; good to fine grocery, 23s. 6d. to 25s., against 22s. 6d. to 25s.; Martinique crystals, 27s. 6d. to 28s., against 27s. to 27s. 6d.; No. 12 Havana, 23s. 6d. to 24s., against 23s. 6d. to 24s.; fair to good refining Cuba Muscovados, 21s. 6d. to 22s., against 21s. 6d. to 22s. 6d.; middling to good brown Bahia, 19s. 6d. to 20s., against 19s. 6d. to 20s.; good to fine Pernambuco, 20s. to 20s. 6d., against 20s. to 20s. 6d.; Paris loaves, 28s. 6d. to 29s. 3d., against 29s. 3d. to 30s.

# THE SUGAR CANE.

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No. 107.

JUNE 1, 1878.

VOL. X.

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 The writers alone are responsible for their statements.

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## THE WEST INDIA MEMORIAL.

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The deputation of planters and merchants which waited on Sir Michael Hicks-Beach on the 8th of May, and the Memorial presented on that occasion from nearly the whole of the landed and mercantile interest of the West India colonies, show that the producers are as little disposed as the refiners to let the question of foreign export bounties rest. A more important demonstration could not have been organized, and the report of the proceedings, which we give in this impression, shows that the case was stated with sufficient force and clearness to make a very distinct and satisfactory impression on the mind of the Colonial Secretary. His reply quite justifies the anticipation not only that the remarkable and perhaps unique injustice of the present position of the British producer and refiner will continue to receive the sympathy and consideration of the Government, but also that the remedy proposed will not again be dismissed without serious examination. A former deputation succeeded in eliciting from the Foreign Secretary the important admission, afterwards repeated by him in the House of Lords, that this is not only a producers' but also a consumers' question, and that it is as much to the interest of the public at large as to that of the grower and manufacturer of sugar that this foreign export bounty should be got rid of. On the present occasion Sir Michael Hicks-Beach fully realized this important element in the question. "It is a strong argument" he says "that after all it is a very short sighted



policy for the consumer to desire the continuance of bounties; for when English Colonial sugar is driven out of the market, the price of foreign sugar will be raised, and the consumer will lose very largely." But, unfortunately, he goes on to express a doubt whether the consumer—by which he means those who defend what they believe to be the consumer's interests—will be able to see the matter in this light. This is where opposition to proposals for a remedy always practically begins. Some are indeed too idle or too prejudiced to listen to and admit sound argument even up to this point. Two members of the present Government have, however, gone so far, and so have some of the best authorities on Political Economy. But the very unsatisfactory and inconclusive conclusion has always been that to which the Colonial Secretary has on this occasion again fallen back,—that, good as the arguments are, Parliament will not be induced to act upon them. Sir Michael Hicks-Beach fears that our representatives will prefer what he himself characterises as a short-sighted policy. There is, we fear, too much truth in this view of the case. The Government sees the real position, but knowingly adopts a short-sighted policy in deference to the narrow, prejudiced, or ill-informed views of Parliament. On a great question this would not be called statesmanship; in a matter of sugar it is not perhaps to be wondered at. A member of the deputation said with much truth that if this were a question of calicoes the outcry would be great indeed. Parliament has, however, been educated on many subjects, and has even profited by lectures on the sugar duties; we may, therefore, hope that the further consideration which Sir Michael Hicks-Beach has promised to give to the question may result in a determination to lead the way to something better than a short-sighted policy with respect to it.

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MACKAY, QUEENSLAND.—The wet season has at length set in, and an abundance of rain has fallen during the past week. The cane crop and other vegetation was beginning to assume an appearance which indicated results of a very distressing character, and although there is now no longer any danger from drought, the growth of the cane has been so much retarded as to seriously affect the prospects of the coming crops.

## THE ENGLISH SUGAR TRADE AND FOREIGN BOUNTIES.

## DEPUTATION TO THE SECRETARY OF STATE FOR THE COLONIES.

On the 8th of May, 1878, a numerously attended deputation of planters, merchants, and others, interested in the sugar trade, waited on Sir Michael Hicks-Beach, Bart., M.P., Secretary of State for the Colonies, for the purpose of presenting a petition with reference to the disadvantage that they are suffering under through the bounties granted by foreign Governments to the merchants and others exporting sugar from those countries. Amongst the members of the deputation were: Mr. Edward Greene, M.P.; Colonel Ireland Blackburne, M.P.; Mr. Duncan M'Laren, M.P.; Mr. Thornhill, M.P.; Mr. T. Daniel Hill, chairman of the West India Committee, and of the Colonial Bank; Sir T. Edwards-Moss, Bart., representing the West India Association of Liverpool; Mr. W. F. Burnley and Mr. J. Lamont, representing the West India Association of Glasgow; Mr. G. H. Chambers, chairman of the London and St. Katherine's Docks; Mr. N. Lubbock, deputy chairman of the West India Committee; Mr. A. Lambert, deputy chairman of the East and West India Docks; Sir Robert Napier, Bart.; Mr. J. F. Daniel, of Messrs. Thomas Daniel & Co.; Mr. P. N. Bernard, director of the Colonial Co., Limited; the Hon. Wm. Russell, late member of the Court of Policy, British Guiana; the Hon. A. C. M'Calman, late member of Court of Policy, British Guiana; the Hon. J. Bell Smyth, member of Legislative Council, Trinidad; Mr. H. J. Jourdain, late member of Council, Mauritius, and of the Messrs. Blyth, Greene, Jourdain, & Co.; Mr. W. M. Ross, of Messrs. Cottam, Morton, & Co.; Mr. R. A. Hankey and Mr. Gurney, of Messrs. Thomson, Hankey, & Co.; Mr. S. H. Curtis and Mr. Quintin Hogg, of Messrs. Bosanquet, Curtis, & Co.; Mr. Jno. M'Connell, of Messrs. Jno. M'Connell & Co., London, and Messrs. Booker Bros. & Co., Liverpool; Mr. Wilding, of Messrs. Hawthorn, Shedden & Co.; Mr. Claud Neilson, of Messrs. Claud Neilson & Sons; Mr. C. D. Manning, of Messrs. Manning & Anderdon; Mr. Wilkinson and

Mr. Gaviller, of Messrs. Wilkinson & Gaviller; Mr. J. Bravo, of Messrs. Joseph Bravo & Co.; Mr. A. Turnbull, of Messrs. A. Turnbull & Co.; Mr. D. C. Da Costa, Mr. C. H. Best, and Mr. W. P. B. Shephard, Barbados proprietors; Mr. W. D. Child and Mr. Hyams, Jamaica proprietors; and Mr. Ohlson, secretary of the West India Committee.

Mr. GREENE, M.P., having introduced the deputation,

Mr. T. D. HILL said that the deputation had attended for the purpose of pointing out the injustice which was occasioned by the protection of beet-root sugar, and to express their anxiety for legislation on a subject of so much importance. Ever since the emancipation of the slaves, the West Indians had been struggling hard for existence; but at one time they thought that their exertions would be crowned with success. They had, however, been overwhelmed by the system of protection adopted by other countries. It was a fact that whilst sugar was a half-penny a pound dearer on the Continent than in England, yet England was drawing large supplies of that commodity from the Continent.

Mr. LUBBOCK then read a statement setting out in full the views of the deputation. The existence of premiums upon the export of sugar from France, Belgium, and Holland has been officially recognised since the year 1863, when a long series of international conferences and conventions commenced. In 1864, a Convention was actually signed by England, France, Belgium, and Holland, with a view of placing the different countries upon an equal footing in regard to the exports of sugar. But this result had never been brought about—foreign Governments have never carried out their engagements. To the above-mentioned Powers, as allowing premiums in one form or another, must now be added Germany, Austria-Hungary, and Russia. In fact, the whole of the beet-root sugar interest throughout the continent of Europe derives advantage from this system of premiums, and to this cause must be attributed in a considerable degree the enormous expansion of the beetroot industry, from an average of 721,770 tons in 1867-8-9 to 1,232,690 tons in 1876-7-8. During the last 20 years the growing demand for sugar has been supplied

by beetroot and slave-grown produce, while the British colonies have been unable, in consequence of the unequal competition to which they were exposed, to take their proper share in supplying the wants of the world. The memorial, which we have now the honour to present, defines the position of the West India Colonies, both in regard to slave labour and bounty-fed sugar. With regard to the former, the memorialists say :—

“That in the colony where your petitioners reside, the cultivation of sugar is the principal industry upon which the public revenue is based and the institutions of Government supported ; by which the labouring population earn wages, and upon which the prosperity of the whole community depends.

“That the said industry has suffered much depression and great restriction for many years past, caused by want of sufficient labour, and by the peculiar difficulties occasioned by your petitioners having had to struggle against the competition of the slave-labour countries of the world, a competition which your petitioners will not cease to protest against as most injurious and unfair.

“That your petitioners have, nevertheless, sustained this competition in the hope that, by the abolition of slavery in foreign countries and colonies, the exertions of your petitioners, and the large capital employed by them in their industry, would at length yield a proportionate return.”

You, sir, will probably admit the truth of the above representation. The sugar industry is, and always has been, the great mainstay of the British West Indies, the natural advantages possessed by those colonies for the production of sugar being unrivalled. And although they have had serious difficulties to contend against in the matter of labour, these difficulties have now been so far overcome as to justify a belief in the return of prosperity, provided only the colonial sugar industry had fair play at home. These difficulties have given the colonies a peculiarly strong claim to the consideration and just treatment at the hands of the mother country.

The succeeding paragraphs of the memorial explain how the bounty system affects the produce of the colonies :—

“That in consequence, however, of the practice of granting

bounties upon the export of raw and refined sugars in many of the sugar growing countries of the world, the industry of your petitioners has of late years, and continues to be, most seriously affected.

“That in France, Belgium, and Holland, in spite of protracted negotiations, and numerous treaties with Great Britain, the system of granting bounties on the export of sugar is still vigorously maintained.

“That a similar system has also been adopted in Austria, Russia, and Germany.

“That the above-mentioned foreign countries protect their native sugar industries, in addition to granting bounties on the export of sugar.

“That the effect is to restrict the export trade in sugar from the United Kingdom, to destroy altogether the British loaf-sugar industry, and to reduce the price of all classes of sugar in the English markets below a natural level.

“That if this state of things is allowed to continue, and the English market is to be governed by the price at which foreign bounty-fed sugar can be sold in it, production must be restricted, except in countries where bounties are granted; the general supply of sugar will be reduced, or the article must be raised at greater cost in countries less suited to its production, and as bounties will hardly be continued when free competition has declined, prices must eventually be enhanced, to the permanent injury of the consumer.”

The direct influence of the bounties is seen in the reduction of prices below a natural level—that is, to a point not determined solely, as it should be, for the consumers’ permanent interest, by the lowest natural cost of production. If a French refiner, for instance, obtains £3 per ton premium on the export of his sugar, it will be seen that he can afford to sell his sugar at £2 less than cost price, and still make a profit of £1 per ton. As a matter of fact, this depression of the market is going on at the present moment. The depreciation in price below cost of production is more than covered by the premium the French refiner enjoys,

whilst it is evident that such depreciation is a direct and absolute loss to the Colonial producer who has to compete with him. And with regard to the interest of the consumer in this question, Lord Derby, in expressing the views of Her Majesty's Government in the House of Lords, in 1875, said, "We are convinced that any advantage of cheapness to the consumer which can be obtained by means of the bounty on foreign sugar will be temporary only, because, if the bounty were continued long enough, and raised high enough to drive the English sugar refiner and colonial producer out of the market, then it follows that the foreign producer would get the monopoly of the market, in which case the price would not long remain at a low rate." It will not be disputed that such an artificial arrangement, and one so contrary to the laws of free trade, cannot in the long run be to the advantage of the consumer.

The imports of sugar (raw and refined) into the United Kingdom from countries where bounties are given or indirectly allowed, have risen from 261,350 tons in 1875, to 320,529 tons in 1877, and are expected to be considerably larger during the present year. The only ground of objection that we could have, of course, to these large importations, is that they do not come under conditions of fair and equal competition. Were such conditions in force, a much larger proportion of sugar would come from countries peculiarly adapted to its production, viz., the British West India Colonies.

The extent to which the English market is fed by these foreign bounty-sugars was still further illustrated by the fact that the customs entries in the port of London, from the 11th to the 20th March, 1878, are entirely made up of raw and refined sugar from the continent, showing an average import for the nine week days included in that period of over 1000 tons per day.

The large quantity of sugar imported into the United Kingdom, and sold under its legitimate free trade value, in depressing, as above stated, the price of British colonial sugar, prevents extension of cultivation, and keeps down the value of property in the colonies, depriving them of their natural advantages connected with the

relative cost of production, and depriving the mother country, too, of the full advantages which the sugar industry of the West Indies offers to its shipping and engineering interests, which advantages are not obtained in the case of the beet sugar production.

The question is now in the hands of Her Majesty's Government. Negotiations with the treaty powers are presumably at an end, while Germany, Austria, and Russia have never come into any international arrangement. We do not know what course is likely to be adopted. It is our duty simply to present the memorial, and to ask you, sir, as the official guardian of the interests of the colonies, to consider seriously the statement it contains, and to take such steps as will induce Her Majesty's Government to adopt any practical means that may be open to them to provide a remedy for the grievance which by this memorial, so largely and influentially signed, the West India colonies have brought before you.

Mr. Lubbock then said, with respect to the memorial he now handed in, that, in the Barbadoes memorial, the complaint as to want of labour was omitted, and, in the Jamaica memorial, the complaint, as to the effect of bounties upon the home market, was put into still more urgent language than in the other petitions. The signatures represented very nearly the whole of the landed and mercantile interest of the West India colonies, whilst members of all classes had numerously signed. The British Guiana memorial was signed by six members of the legislature, by 331 proprietors, planters, representatives of estates, and merchants, and there were 109 miscellaneous signatures, including those of clergymen, district medical officers, schoolmasters, tradesmen, &c. The Trinidad memorial was signed by four members of the council, the chairman of the Planters' Association, and by 221 proprietors, planters, merchants, &c. The Jamaica memorial was signed by one member of council, three justices of the peace, the president of the Cornwall Agricultural Club, and custos of the parish of St. James; by 208 proprietors, planters, and merchants, and 230 miscellaneous. The Barbadoes memorial was signed by one member of council, the speaker, and 11 members of the House

of Assembly, the Presidents of the Commercial Hall and Agricultural Societies, 211 proprietors, planters, and merchants, and 105 others. The St. Vincent Memorial, by 72 proprietors, planters, and merchants (including several members of legislature), and 83 miscellaneous. The Grenada Memorial, by 170 proprietors, planters, and merchants (including four members of legislature), and 38 miscellaneous. The Domingo Memorial, by 129 proprietors, planters, merchants, &c. The Tobago Memorial, by 43 proprietors, &c. The Nevis Memorial, by 87 proprietors, &c. The Montserrat Memorial, (including members of legislature), by 54 proprietors, &c. The St. Kitt's was signed by the vice-president of the Leeward Islands' council and 12 members of federal and local councils, 126 proprietors, planters, and merchants, and 47 others. The Antigua Memorial was signed by the president of the federal council, 10 members of the federal and local councils, 100 proprietors, planters, and merchants, and 46 others. The total number of signatures to the memorials was 2410.

The petition, which was then formally presented, set out :—

1. That in the colony where your Petitioners reside, the cultivation of sugar is the principal industry upon which the public revenue is based, and the institutions of Government supported; by which the labouring population earn wages, and upon which the prosperity of the whole community depends.

2. That the said industry has suffered much depression and great restriction for many years past, caused by want of sufficient labour, and by the peculiar difficulties occasioned by your Petitioners having had to struggle against the competition of the slave-labour countries of the world, a competition which your Petitioners will not cease to protest against as most injurious and unfair.

3. That your Petitioners have, nevertheless, sustained this competition in the hope that, by the abolition of slavery in foreign countries and colonies, the exertions of your Petitioners, and the large capital employed by them in their industry, would at length yield a proportionate return.

4. That in consequence, however, of the practice of granting



bounties upon the export of raw and refined sugars in many of the sugar-growing countries of the world, the industry of your Petitioners has of late years, and continues to be, most seriously affected.

5. That in France, Belgium, and Holland, in spite of protracted negotiations and numerous treaties with Great Britain, the system of granting bounties on the export of sugar is still vigorously maintained.

6. That a similar system has also been adopted in Austria, Russia, and Germany.

7. That the above mentioned foreign countries protect their native sugar industries, in addition to granting bounties on the export of sugar.

8. That the effect is to restrict the export trade in sugar from the United Kingdom, to destroy altogether the British loaf sugar industry, and to reduce the price of all classes of sugar in the English markets below a natural level.

9. That if this state of things is allowed to continue, and the English market is to be governed by the price at which foreign bounty-fed sugar can be sold in it, production must be restricted except in countries where bounties are granted; the general supply of sugar will be reduced, or the article must be raised at greater cost in countries less suited for its production, and as bounties will hardly be continued when free competition has declined, prices must eventually be enhanced, to the permanent injury of the consumer.

10. That while your Petitioners cannot expect Her Majesty's Government to secure equal competition for British sugar in foreign markets, they are bound to believe that Her Majesty's Government will be disposed and able to secure that result in the home markets of the United Kingdom.

11. That it would be strictly in accordance with the commercial policy of Great Britain to remove from the foreign sugar imported in the United Kingdom, any artificial advantages that accrue to it from its having obtained a bounty on export, the result of such removal being to restore a natural free-trade competition.

Your Petitioners therefore humbly pray that you, sir, would be pleased to take the above statements into your serious consideration, and to adopt such measures as will result in Her Majesty's Government, either by special treaty, or in any commercial treaty that may be negotiated, binding the Governments of France, Belgium, Holland, Austria, Russia, and Germany to abolish bounties on the export of sugar. And, failing to secure by these means international free-trade, your Petitioners would further pray that you, sir, would adopt such measures as would lead to Her Majesty's Government proposing to Parliament the imposition of a countervailing duty upon all foreign sugar imported into the United Kingdom, equal to the bounty which the said sugar has obtained on export, and that such duty shall be continued upon sugar imported from any foreign country so long as the bounty upon the sugar is granted, directly or indirectly, by the Government or Legislation of that country, or otherwise in any manner obtained.

And your Petitioners, as in duty bound, will ever pray, &c.

MR. G. H. CHAMBERS referred to the unfairness of the struggle when slave labour was brought into competition with free labour. As long as England took the produce of her own colonies, fully three-fourths of the money paid was spent with us again, but, now that so much was being taken from Cuba, not one-tenth of the money was so spent. Fortunately the importation of slaves to Cuba had been to a great extent prevented. The failure of France and Spain, however, to carry out the promise to put the sugar trade on a fair footing had done a great deal of injury. The right was, therefore, with the English traders, and they left it to her Majesty's Government to press that right as opportunely as possible.

SIR T. EDWARDS-MOSS said the English planters had been told that the real remedy, for what they complained of, was the extended use of machinery for the saving of labour. In answer to that he had to say that machinery had been imported to the West Indies to an extent that, if anything, went beyond what the circumstances would justify. During the four years ending in March of last year there had been a loss of £7000, or £8000, on an estate of his,

and another estate, which he took over for four or five years, produced nothing, owing to the way in which it was handicapped. The English proprietors and planters had one great crime, and that was that they were a small and weak body. He was afraid that before long they would add another crime—that of poverty. If larger interests were affected in a similar way—if, for instance, foreign countries gave a bounty of 15 or 20 per cent. on calicoes—the outcry would be very great indeed.

The Hon. W. RUSSELL (Demerara), said that, as a practical grower of sugar cane, he was able to state that there was no better climate for growing it than in the colony from which he came, and and yet since the abolition of slavery there had only been one sugar plantation put into cultivation. This clearly showed how heavily the English planters were handicapped. The sugar cane of the West Indies yielded double the saccharine matter that beet-root did, and this fact, coupled with the fact that it is almost shut out of the market, proved the great injustice which existed. Last year there was a short beet crop, and the sugar refiners had recourse to British Guiana for their supply of sugar. This was refined in France and then exported to this country. The planters of British Guiana could double their produce if they had fair play. He hoped the action taken in London would bring about a more equitable state of things.

Mr. JOURDAIN (Mauritius) said that perfect machinery was used in the English colonies, and white sugars were produced which could be sent to England, if they had not to compete with beet-root sugar, on which a bounty had been paid. The consequence was that the white sugars were sent to Australia. It was fortunate that there was so good a market near at hand, but the Australian traders, knowing that the sugar could not be sent to England, obtained it practically on their own terms.

Mr. M'LAREN, M.P., gave an instance of a large sugar company that had carried on business for years at a loss, in hope that the injustice which existed would be remedied, but at last it had been necessary to wind it up. He believed that similar things were taking place in other parts of the United Kingdom. He was aware

of all that had been done by her Majesty's Government to induce the French and other Governments to do what was right, and that promises had been made by those Governments which had never been performed. The point was, what power existed to make them act justly. He was opposed to anything that could be called protection, but this was a question, not of free trade, but of free trade handicapped. He would suggest that the Government should do, with respect to sugar, something similar to that which had been done with respect to spirits. At one time 10s. a gallon was charged on all kinds of spirits, but it was found that the distillers in this country carried on their trade at a great disadvantage. In consequence of this a duty of 2d. additional was charged on colonial spirits and 4d. additional on all foreign spirits. At that moment, whilst the distillers of this country were paying 10s. a gallon, France, Germany, and other countries were paying 10s. 4d. a gallon on spirits. He would venture to suggest that as the foreign bounty on exported sugar was one-third of a penny on the pound weight, an equivalent temporary duty should be laid on so long as that continued, but that if France should do away with the bounty an Order in Council should abolish the duty as far as it concerned France. He thought that in this way a great act of justice would be done to the sugar refiners in this country. If such a duty could not be defended in the case of sugar, it could not be defended in the case of spirits.

Sir M. HICKS-BEACH asked whether the deputation had any statistics with reference to the increase in the export of raw and refined sugars from the colonies which they represented.

Mr. LUBBOCK said they had no statistics with them, but he could state generally that whilst there had been a slight increase in the exports of the West Indies during the past 30 years, the exports of Cuba had increased three-fold.

Sir M. HICKS-BEACH said the point was an important one.

Mr. LUBBOCK said the point was whether the trade of the English colonies had increased *pro rata* with that of other colonies. It had not done so, but had only increased very slightly.

Sir M. BEACH HICKS said—The petitions, which have been signed by so many persons in the West Indian colonies, conclude

with a prayer, and two alternatives are suggested. The first is, that further treaties should be negotiated binding foreign Governments to abolish the system of bounties; and the second is, failing renewed treaties, that a countervailing duty such as was alluded to by Mr. M'Laren should be imposed. With regard to the first of these alternatives the deputation, I am sure, are better aware than I can be, from their long acquaintance with the subject, that the Government have already done a great deal—in fact, all in their power, to deal with this matter by way of treaty. I am afraid it must be admitted that in the foreign countries, with which those treaties have been made, the interest of the producer predominates over that of the consumer, and therefore, of course, inducements are apt to be held out by the Governments of those countries, with respect to bounties, such as that we have been discussing to-day, and other things are done which in our minds are almost indefensible. Those negotiations to which I have alluded are still continuing. I am bound, however, to admit, so far as I can judge, that there is not a very hopeful prospect of their arriving at a satisfactory conclusion. I think that is due mainly to the point to which I have alluded, and if those interests (the producers') have prevailed in the past, in the case of France at any rate, so much as to prevent the Government of that country fulfilling the engagements they had absolutely entered into, I am afraid it is too probable they will prevail in future, and prevent the Government assenting to any such treaty as that you desire. Then I come to the second alternative—the imposition of a countervailing duty on all foreign sugar on which a bounty has been paid. We must remember that in this country the interest of the consumer is stronger than the interest of the producer; and of course it is clear that the effect of these foreign bounties, as far as the present day is concerned, is that the consumer gets his sugar more cheaply than he would without them. That is the difficulty we have to deal with. It is a strong argument used by the deputation, and by Lord Derby in 1875, that after all it is a very shortsighted policy for the consumer to desire the continuance of bounties, for when English colonial sugar is driven out of the market the price of foreign sugar will be raised, and the consumer will lose very

largely. But I am afraid it would be extremely difficult to convince the consumer in England with regard to such a subject as sugar, that a system of import duties of this kind would be justifiable, or that sugar, as Mr. McLaren suggested, should be taxed as spirits are taxed. Of course, I need not allude to the difference of the whole system of taxation on the two articles, and I do not think it follows that, because a duty is imposed on the importation of foreign spirits on the grounds named, the House of Commons would agree to the imposition of a similar duty on sugar on the grounds pointed out by the deputation. I think it will be admitted that the subject is very full of difficulty. For my own part, I have heard much to-day, and many statements have been made by those who have spoken, with which I very much sympathise. Whether it is possible to do anything to meet the views you have urged upon me I cannot say now. I do not think it would be advisable that I should attempt to express a definite opinion upon so important a question after having been able to devote so short a time to its consideration. I will carefully give my attention to the memorial and the points you have laid before me, and I will communicate with the other departments of the Government, with whom, I believe, you have already been in communication, with a view to seeing whether anything further can be done. If any further points occur to any gentleman which might be laid before me with a view to strengthening your case I should be glad if they may be forwarded to me.

#### VISIBLE SUPPLY OF SUGAR.

	1878. Tons.		1877. Tons.		1876. Tons.
United Kingdom .....	168,437	..	146,729	..	172,256
France .....	114,000	..	128,582	..	164,968
Holland .....	41,015	..	18,015	..	36,520
Germany .....	48,615	..	35,110	..	39,140
United States.....	57,101	..	54,116	..	95,200
Havana and Matanzas ....	34,985	..	76,445	..	84,025
Afloat.....	79,665	..	88,961	..	70,000
	<u>543,818</u>		<u>547,958</u>		<u>662,109</u>

## SUGAR BOUNTIES.

(From the Reports of Secretaries of Legation and Consuls.)

The extent of the production of beetroot sugar, which production is fostered and protected by bounties in one form or another, may be seen from the following table:—

*Production of beetroot sugar.*

	Tons.		Tons.
For three years, 1867-8-9 ..	2,165,310	Average	721,770
„ „ 1870-1-2 ..	2,958,786	„	986,262
„ „ 1873-4-5 ..	3,329,577	„	1,109,859
„ „ 1876-6-8 ..	3,698,072	„	1,232,690

*The crop ending in 1878 is thus distributed.*

	Tons.
Germany .. .. .	370,000
France... .. .	370,000
Russia .. .. .	220,000
Austria-Hungary .. .. .	245,000
Belgium .. .. .	65,000
Holland and other countries .. .. .	25,000
	<hr/> 1,295,000 <hr/>

*Mr. Nicolson's Report on the Sugar Industry of Germany, 1876.*

In Germany the sugar duty is imposed upon the weight of roots, but the bonus upon export stands in no proper relation to the amount of the tax. As the tendency is to obtain an increasing quantity of sugar from the beetroot, so the premium upon export becomes larger. 12½ cwt. of beetroot are estimated to produce one cwt. of raw sugar, but the actual yield is much greater. Less than 11 cwt. of beetroot produces one cwt. of sugar. A drawback on exportation is therefore given on a quantity of sugar which had not previously paid duty, and it is calculated that a bounty of at least 3s. per cwt. is granted in this way. Besides this export bonus, the beet industry of Germany is protected by a customs duty of 12s. per cwt. on raw Colonial sugars, against an

excise of 10s. per cwt. on raw beet sugars. This advantage is, of course, enhanced as the actual yield of sugar from the beetroot becomes increasingly greater than the Official yield on which the duty is calculated.

In France the duty is levied on an estimated yield, not of raw sugar from the beetroot, but of refined from raw sugar. And as a certain quantity of raw sugar really produces more than the Official yield, a drawback is given on a quantity of sugar that has not previously paid duty. Lord Derby described the French system as follows, in the House of Lords, on 22nd July, 1875.—“The way in which such unfair advantage is secured is this: the duty levied on sugar is measured by the estimated yield of refined sugar from a certain quantity of raw material. If this yield is underestimated, as has generally been the case, then the drawback granted on exportation operates as a bounty, that is to say, suppose a refiner has paid duty on an estimated yield of 90lbs., he really obtains 95lbs. and he gets the drawback on 95lbs. A sum is therefore refunded to him which he has never paid, and which is clear gain into his pocket. It is owned that the French Government are paying in this way a bounty of £800,000 a year.” The complicated system of classification and analysis by which the duties are assessed in France, gives other advantages to the refiners in that country. It is not suprising, therefore, that exports of sugar (including every class, raw, refined, indigenous and colonial) from France have increased from 87,000 tons in 1862 to 306,526 tons in 1875. These large exports show that the production has been stimulated excessively, and that to keep open channels of export, even at vast expense, by the Public Treasury, is essential to the maintenance of the industry at its present extent.

*Mr. Michell's Report, Dec., 1877.*

In Russia the following state of things exist: “Since the establishment of the increased rates of drawbacks on sugar, in October, 1876, the sugar industry in Russia has largely developed, and a great impetus has been given to the exportation of Russian manufactured sugar to foreign countries. According to the last Russian customs returns, which comprise a period of nine months



of the present year, *i.e.*, from the 1st of January to the 1st of October, 1877, 3,180,846 pouds (51,120 tons) of raw and 178,439 pouds (2868 tons) of refined lump sugar were exported from Russia during that time, the exportation of this commodity having been, during the last and other preceding years, altogether insignificant. In addition to the premium offered to the native manufacturer in the shape of a high bounty on his exported produce, the disposal of Russian sugar abroad was favoured by the scarcity of French and other beet sugars in the market, and the consequent high prices that prevailed. The low rate of exchange existing between Russia and foreign countries this year has also tended to increase exportation of sugar, particularly to England, where, it is said, Russian grown sugar has found great favour, owing to its good quality. Further encouragement was afforded to Russian sugar manufacturers last year by the advance to a syndicate of such manufacturers of 3,000,000 roubles (£450,000) by the State Bank on very favourable terms. This loan has not yet been refunded to the bank, and the period for its repayment has been extended over a considerable time."

The native industry of Russia is also protected by a high customs duty on cane sugar. In nine months of 1877 only 18 tons of cane sugar were imported into Russia.

*Mr. Harriess-Gastrell's Report, 1876.*

Austria exports large quantities of raw sugar under bounty. In that country there is a very lax system of taxation on roots. A very considerable proportion of the excise duty is paid away in the form of drawback, and there is no doubt that this drawback operates as a bounty. Only a very small quantity of sugar has been exported which has not profited by this drawback. From the table given in the report, it appears that this drawback system only commenced in 1863, and in 1874 had arisen to such an extent as to absorb 7,595,243 florins out of a total taxation of sugar of 9,528,648 florins, leaving only as the balance received by the State, 1,933,405 florins. It will be evident from these figures, that sugar taxation in Austria exists for the purpose of protecting the sugar industry of that country, of

keeping open channels of export by purely artificial means, and of unduly stimulating the production of an article which the bounty allows to be exported at an unfairly low price, with the result of forcing sugar below its real value in the markets of the world. Mr. Hariss-Gastrell states "It is acknowledged that the quantity of beetroots returned for taxation as manufactured into sugar is notoriously less than the actual quantity." He further says, that the drawback is probably, to nearly half its amount, a real bounty on export. "Hence the Austrian manufacturer can send his sugar abroad at a very low price."

*Sir Harry Barron's Reports on Belgium, 1865 and 1873.*

With regard to Belgium, Sir Henry Barron, in commenting upon artificial and one-sided arrangements, said, in 1865, "sugar would be cheapened for export at the public expense, each country would refine for its neighbours, and an artificial traffic would be created. Every source of science and fraud would be directed towards securing a bounty." The manufacturer in Belgium pays duty, not on the quality or type of the sugar really made, (the excise does not even see it) but on the presumed yield in sugar of the beetroot juice passed through the defecating pan. The real result varies but is always greater (sometimes 9 per cent.) than the official figure. "The supposed yield is obviously a mere imaginary average of an average. Consequently the taxation represents a mere fiction, certainly not the accurate proportion stipulated by the Convention. The Treasury reimburses to the manufacturer the exact amount of duty, not which he has paid but which he is supposed to have paid. It is clear that by this system the more sugar is exported the greater is the quantity of surplus sugar ("excedants") above the presumed yield remaining available duty free for home consumption. If ever this 'excedants' should suffice for the home consumption, the revenue from sugar would evidently be entirely exhausted by the drawback, leaving nothing to the Treasury." To obviate this, an Official minimum of revenue from sugar was compelled to be established.

In Holland a similar system of assessing duty on the presumed yield from juice is in force.

It will thus be seen that the great beetroot sugar producing countries maintain their respective industries, first by bounties on export, and second by customs duties shutting out colonial sugar.

Germany, Austria and Russia have never come into any International arrangement. Since 1864, there have, however, been many Conferences held, and abortive Conventions made between Great Britain, France, Holland and Belgium. France and Holland agreed, in the draft Convention of March, 1877, to adopt a system of stricter supervision, and Belgium to reduce her duties. This Convention has never been ratified, and Holland has now (March, 1878,) given formal notice that the terms of the said draft Convention are unacceptable, that the best arrangement that could be made would be a reduction of the duties, but that the state of the finances will not allow of this, and the Cabinet of the Hague regrets "not to be able to find, for the time, any basis, so far as the Low Countries are concerned, for the conclusion of an International arrangement." This withdrawal of Holland, necessarily brings negotiations to an end, and allows the British Government to take that independent action which British interests, if they are to be maintained at all, imperatively call for.

The imports of sugar (raw and refined) into the United Kingdom from countries where bounties are given on export are as follows :—

	Tons. 1875.	Tons. 1876.	Tons. 1877.
Germany .. .. .	28,100	76,000	99,600
(Principally Austrian sugar, via German Ports.)			
Holland.. .. .	29,596	47,159	31,045
Belgium .. .. .	30,986	32,303	23,596
France .. .. .	147,685	123,364	126,132
Other Countries (Russia, &c.)	14,983	14,999	40,156
	<u>261,350</u>	<u>293,825</u>	<u>320,529</u>

It should be explained that the beet crop of 1876-7 was, from purely natural or climatic causes, an exceptionally bad one. The crop of 1877-8 will be at least 25 per cent. greater, and the exports to Great Britain of course proportionately more.

The extent to which the English market is fed by these foreign bounty sugars is still further illustrated by the fact that the Customs entries in the port of London, from the 11th to the 20th March, 1878, are entirely made up of raw and refined sugar from the continent, showing an average import for the nine week days included in that period of over 1000 tons per day.

The large quantity of sugar imported into the United Kingdom, and sold under its legitimate free trade value, necessarily depresses the price of British colonial sugar, prevents extension of cultivation, and keeps down the value of property in the colonies, deprives those colonies of their natural advantages connected with the relative cost of production, and prevents them from maintaining successfully the competition against slave grown sugar, a competition the inequality of which is sufficiently shown by the fact that the labour of 450 people in Cuba is equal in the production of sugar to that of 2000 people on an estate in a British West India colony.

The bounties given by foreign countries really constitute a tax upon English producers. To remove this tax would be to restore free trade and equality, and this could, in the circumstances, only be done by a countervailing duty. In the Convention of 1864 it was agreed that a countervailing duty should be considered in case of bounties being given by non-contracting powers, and in the draft Convention of 1877 the principle was again recognised. Sir Henry Barron, in the report quoted above, affirms this to be the only remedy. A duty to the extent of the bounty would not be prohibitory, but purely countervailing, that is, it would take for the benefit of the revenue the artificial advantages possessed by the sugar, in the same way that a similar duty takes from foreign spirits the advantage they possess on importation by not being subject to the disabilities of English excise.

Great Britain is the largest sugar centre in the world, but so far from the British sugar Colonies benefitting by this, they are on the contrary subject to disabilities as compared with all other important sources of supply. A countervailing duty would not restrict the supply of sugar to Great Britain, for so long as there was a demand, sugar would come from every source of pro-

duction, only it would come on fair terms, and our own colonies, from the natural advantages they possess, would supply the consumer with sugar at the lowest possible cost of production. The effect of a duty would be seen in the abolition of foreign bounties. When they do not pay, and have no effect, they will soon disappear. Foreign Governments will quickly become tired of spending immense sums out of the taxes of the people in artificially propping up a particular interest, when such support would be useless, and would not tell in a free and open market. Because, therefore, it would be fair in itself and a cause of fair dealing in others; a countervailing duty of (say) 3s. per cwt. should be imposed upon refined sugar, and a proportionate one on raw sugar imported from France, Belgium, Holland, Germany, Austria, and Russia, so long as those countries continue to grant bounties on exportation.

Such duty would be favourable to the permanent interest of the consumer. Lord Derby in expressing the views of Her Majesty's Government in the House of Lords, in 1875, said "we are convinced that any advantage of cheapness to the consumer which can be obtained by means of the bounty on foreign sugar will be temporary only, because, if the bounty were continued long enough and raised high enough to drive the English sugar refiner and colonial producer out of the market, then it follows that the foreign producer would get the monopoly of the market, in which case, the price would not long remain at a low rate."

*West India Committee, 9, Billiter Square, London.*

*March, 1878.*

An important meeting of the central executive committee of Operative Sugar Refiners, affected by the continental bounty system, was held on May 25th, at Bristol. The secretary reported that employers in the refining districts throughout the country were co-operating with the workmen, and that a national conference of delegates to consider the question of the sugar bounty system would meet in London towards the end of June.

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QUEENSLAND.

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SECOND ANNUAL REPORT OF THE BOARD APPOINTED TO ENQUIRE INTO  
THE CAUSES OF DISEASES AFFECTING LIVE  
STOCK AND PLANTS.

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In our July issue of last year we gave an account of Dr. Bancroft's researches into the cause of cane disease then so prevalent in Queensland. We have now before us a Report bearing the above title, from which we make the following extracts, containing, we may presume, the results of the latest experiments on that important subject, with practical suggestions for the extirpation of the evil:—

With a view to making experiments with sugar cane, a piece of land at New Farm has been planted with different varieties. These canes have been too recently planted to afford much material for experimental investigation.

It has been deemed desirable to introduce all the different varieties of sugar cane cultivated in sugar-growing countries, and to subject them to such tests as shall determine their adaptability to our soil and climate. Mr. Walter Hill has, therefore, been authorised by the Board to procure as many varieties as he may be able to obtain.

Under the auspices of the Board, Mr. Angus Mackay has arranged for a large and varied collection of canes from the United States of America and the West Indies. These are daily expected, and on their arrival will be disinfected and planted in the Board's experimental plantation.

The disease known as rust in sugar cane has received a large share of the attention of the Board during the year. The results of Dr. Bancroft's investigations have thrown a new light on this subject, showing that rust arises from the combined action of insects and fungi, thus indicating that a remedy may be found by dressing the cane plants with chemical solutions.

REPORT ON EXPERIMENTAL GROUND, NEW FARM,

*By Mr. Walter Hill.*

With a view of determining the varieties of sugar cane most

suitable for cultivation in the southern districts of the colony, and of instituting a series of experiments for the purpose of testing the possibility of the eradication of rust and other diseases, which, for some seasons past, have materially affected the cane plant throughout the greater portion of Queensland, this Board rented a piece of land of about five acres in extent, the property of Mr. J. S. Turner, situated on the New Farm road. It was decided by the Board that the ground should be prepared for the reception of the cane plants in the ordinary manner, and the preparation of a portion of land, viz., ploughing 5 inches in depth, cross-ploughing, and harrowing, was performed under the supervision of Mr. G. Grimes.

Three varieties of cane—Ouatamiti, Cheribon, and Mah—were obtained from Mr. George Raff's plantation, Caboolture, and were planted in the month of February, 1877. The canes were planted as follows :—

No. 1. Containing three rows of cane plants, 130 yards in length, with a distance of six feet between the rows.

No. 2. Containing two rows of each of the above-mentioned varieties, 17 yards in length, with a distance of six feet from row to row. One row of each variety was planted with cane-tops, and another with cuttings from the stem of the cane. This course was adopted in order to test the comparative germinating powers of the different descriptions of cuttings. On examination of the canes on July 6th, the plants in No. 1. had not made as much growth as might reasonably have been expected ; this may be in some measure attributable to the insufficient preparation of the soil (for, instead of a five-inch ploughing, the depth, upon examination, was found to be barely three), and the advanced period of the season when the planting was completed. The Cheribon variety exhibits indications of having suffered from climatic effects, and presents a diseased appearance, differing from that known as "rust" in cane. The diseased portion of the leaf, when submitted to the microscope, presents a purplish violet appearance—in some instances inclining to a reddish pink on the underside of the leaf, dotted with patches of a sort of whitish mycelium. The discolouration of the upper

surface of the leaf is not so marked as that of the underside. This apparent fungoid growth appears to differ in many respects from the ordinary cane rust, but further investigation will be required before a correct opinion as to its nature, cause, effect, and possible mode of prevention can be arrived at. In furtherance of this object, and at the request of Dr. Hooker, director of the Royal Gardens, Kew, I have forwarded to him specimens of diseased canes in various stages, for the purpose of examination. Specimens have also been submitted to competent microscopists in the southern colonies, and in a short time I hope to be in possession of their opinions as to the nature and probable cause of this disease. Under the surface of the ground new buds are forming, and, up to this time, whatever its subsequent effect may be, the disease does not appear to have materially injured the cane plants.

In No. 2, in the three rows planted with cane tops, few misses are perceptible, and the canes generally have made progress; whereas, in three rows planted with stem cuttings, in two of them the whole of the plants have failed to germinate, and in the third row many deficiencies are apparent.

In the month of March a selection of eleven varieties of sugar cane were obtained from Mr. George Grimes, Oxley. Upon arrival the canes were found to be much infested with borer, and upon some of them a whitish plant louse was detected. Upon examination with the microscope this insect proved to be a pink-bodied acarus, covered with a whitish waxy substance—most probably a provision of nature for the protection of the insect from the effects of moisture; on either side—along the outer edge of the body—are fifteen feet, like projections, which at the first glance, might easily be mistaken for the true feet. On turning the insect on his back, the eight true feet and two small antennæ are visible. This insect appears to dislike the light, and when exposed quickly, endeavours to make for cover. Three rows of each of the varieties, 70 yards in length, were planted, and all appear to have thriven with the exception of the Salangore variety, which is affected in a similar manner to the Cheribon, and most probably from the same cause. Upon examining the plants under the surface of the ground, fine and healthy young buds were



forming; and if the forthcoming season prove favourable to the growth of the cane plant, there is every probability of the disappearance of the disease.

The superior progress of these canes, as compared to that of Nos. 1 and 2, must, in a great measure, I consider, be attributed to the better and more careful preparation of that portion of the experimental ground occupied by them. Subjoined will be found the list of varieties of sugar cane obtained from Mr. G. Grimes:—

LIST OF SUGAR CANES FROM MR. G. GRIMES.

<i>Sorghum saccharatum</i> :—		Variety—Socrat.	
Variety—Rappoe.		„	Malabar.
„ Chigaca.		„	Ribbon.
„ Troeboe.		„	Schemeie.
„ Yellow.		„	Guinham.
„ Meera.		„	Salangore.

In the month of April a further supply of cane plants was received from Mr. George Raff, Morayfield, consisting of the Purple, Green, and Ribbon varieties. The whole of these canes (except the purple) were infested with plant lice. The number of canes obtained were sufficient to plant two rows of each variety, 70 yards in length.

On July 6th the young plants were examined by me, and a considerable number of plant lice were found upon the roots, but none were detected upon the leaves. Upon examination under the microscope the insect appeared somewhat similar in size and form to that discovered on the canes obtained from Mr. Grimes, but differing from it in colour, the body being dark, but covered with a similar whitish waxy substance, and not possessing the fifteen footlike projections on either side of the body, and, unlike the former, this louse is furnished with only six legs. I must also mention that the root of *Helopus annulatus* a number of similar lice were found. This plant was growing within a short distance of the sugar cane. Neither of them appeared to have suffered to any great extent. It is possible that these insects have been driven by the cold to take refuge in the roots, and that their increase may be found upon the leaves in the forthcoming spring; but this is merely

a matter of surmise, as the observations have not yet extended over a sufficient period of time to enable me to arrive at a correct estimate of their habits.

Before concluding, I am desirous in this report of placing my previously expressed opinion on record, and, after careful consideration, I find no reason to deviate from it, viz., that the course most calculated to benefit the sugar producers of this colony is not to eradicate the canes already planted—as has been proposed—and to replace them with cane plants which have been prepared for the purpose of resisting disease, but by careful experiment upon the diseased canes that we already possess, to endeavour to discover the cause of disease and the means of its eradication, or, at all events, the mitigation of its effects. The theoretical prevention of disease, though apparently perfect, has in many instances failed when practically applied upon extensive areas, notably in the case of *Phylloxera vastatrix*, where numbers of infallible theoretical remedies, when attempted to be put into practice, signally failed. What the sugar growers of this colony require is a method of destroying the disease as it appears amongst their standing canes, without going to the expense of rooting out their crop and replanting it with prepared cane plants; a course that in many instances, even if efficacious, would prove beyond the means of the majority of cultivators. It is to the solution of this question that I consider the contemplated experiments of the Board should tend. This will be more apparent when the immense reproductive power of this group of insects is taken into consideration, for it is stated by Reamur, who has probably investigated the mode and rate in which these insects increase better than any other naturalist, “That a single individual may be the progenitor of six thousand millions of individuals during the life of five generations;” thus, if only a few plant lice escaped destruction by the dressing process (which has already been the case in a small experiment, and would certainly occur when large quantities were operated upon), those few individuals, in consequence of their enormous reproductive powers, would be perfectly able to re-stock the whole plantation in a very short period of time, and thus the dressing of cane plants, as a means of prevention, would ultimately

prove futile. In addition to the danger to be apprehended from the lice that escaped destruction in the dressing process, the growing canes would always be liable to be infected from adjoining plantations where disease is prevalent. These and many other facts tend to show that our attention should be directed to the discovery of some method of eradication or prevention capable of application in an economical manner to standing crops over large areas, and one that could be used without difficulty in the course of ordinary agricultural operations.

#### DEVELOPEMENT OF SUGAR CANE DISEASE.

##### *Dr. Bancroft's Observations and Recommendations.*

My first paper on this subject, together with drawings of diseased canes, was written in August, 1876, and is published in the report of the Board of Enquiry into the Causes of Diseases of Live Stock and Plants. Shortly afterwards I obtained specimens of diseased canes from Mr. Raff, Mr. Grimes, and Mr. Hill of the Botanic Gardens. There were altogether about fifty varieties, all of which showed the rough patch at the joint which is previously spoken of by me as "fungous tuber," I selected from these a piece of each kind, had the trash carefully removed, and all remains of it trimmed off the joints. They were then immersed in lime newly slaked in water, at the rate of 2lbs. to the gallon. On some the lime was allowed to dry; others were planted at once. A few specimens perished from various causes. I now count forty-five stools of cane of great diversity of character. During the summer I watched weekly the progress of these canes, and saw various trifling diseased conditions. Some spots on the leaves, very small, are due to the bite of minute insects—thrips and red spider.

An orange red fungus grows on the dead trash attachment of the lower leaves with the stem where wet with earth. It grows with a small head on a fine thread. The heads soon adhere together, when the appearance is like a many-legged red stool. With a magnifying power of about 100 this may be easily recognised by observers. It is the first fungus I noticed before the summer rains; it is by no means common; does not attach itself to the cane stem, and to all appearance is harmless.

A second fungus was observed later; on one stool of canes some of the lower sheaths looked red, and on lifting them a white fungus like white cotton was seen in great plenty, with a small granule about as large as a pin's head—possibly its fruiting organ. This again only grew on the decaying sheaths. As the lower leaves of the growing canes gave signs of loss of vitality they were carefully removed, and red rusty patches above the buds were carefully sought for, but were not discovered until February, and then on one stool of canes only.

I cut off the first cane I found, and on removing the sheaths higher up found abundant red incrustation giving off what appeared to the naked eye a white powder. I carried this cane top home, thinking now to see the red incrustation in fruit, and to discover the clue to the extension of the so-called rust. Uncovering a fresh joint, I placed the red crusty patch under the microscope. Now the white powdery stuff was clearly no fungus spore, but an old acquaintance, the acarus figured in my former paper, not in ones or twos but in hundreds.

On a single cane in this condition there are of these mites, males, females, and eggs, an innumerable host. On close inspection of the other canes I could discover no mites except those of the same stool; this, however, did not last long, and each succeeding visit I found them further and further on the row until many of the contiguous canes, whose foliage touched, were in a slight degree affected.

Some that are not in contact are at present free, and Bourbon canes I have growing at my stables in Brisbane without any mites on them, the joints of which were limed before planting. The Bourbon I notice to have patches on the cane where the glossy covering is absent. This seems to be some defect in the growth of the plant, and is in no way connected with the ravages of the mite. To look at these canes, the sugar planter or gardener would pronounce all the stools perfectly healthy, and those canes that harbour colonies of mites in their upper sheaths at the present time (May 16th, 1877), look quite as well to the eye as those that are perfectly free. All specimens, with the rough patch on the stem, show, on removing the upper sheathes, the same incrustation more strongly

marked. The lower joints may be quite clear and glossy ; higher up, a little roughness may be seen that cannot be wiped off with the wet finger ; and on removing the sheathes that are yet green, colonies of the living mite are to be found. Under the highest sheathes the incrustation may be still pale ; there the insects and eggs are plentiful.

The incrustation may even be found on the blades of the leaves in the centre of the shoot. When the leaves unfold, the acarus leaves this part and finds its home between the sheath and the cane. Here it may be seen in great numbers, immersed after rainy weather in water, in which nevertheless it lives and thrives. I incline to the opinion that rainy weather favours the spread of the acari. They do not like the sunlight, for if placed under the microscope with bright sun shining on them, they may be seen to creep to the under side of the section. *Leptus autumnalis* is an acarus very similar to this mite, having like it, six legs only. Possibly the cane mite will prove of the same genus. I have no doubt but that the bite of the cane-mite causes the growth of the white blisters, which afterwards become red and shrink into the form of cups ; then the cups become surrounded with fungous threads, and all observers hitherto, as far as I know (including myself), pronounced the whole incrustation, vesicles, cups, and mycelium, to be the different conditions of one fungus. The mite was also seen, but its true significance was not clear. Under the upper sheathes the vesicles and mites exist without any fungous threads. Here and there mycelium may be seen starting up, unconnected with the vesicles. The fungus, which I take to be the common sooty mould of the cane, is to be found on canes that have no mites on them. Spores of this, germinating on the site of the mite colony, may give rise to the threads, but this point I have not yet determined. The fungus appears to start into growth much in the same manner as various fungi attack the scale insects of the orange tree, one of which covers the leaves with black mould. This is never, to my knowledge, seen on an orange or other plant, except scale insects or coccus hoppers of some kind are present also, in the honied secretion of which the mould thrives ; ants also are often present seeking the honey. As I am travelling a little way

from the subject to show an illustration of the growth of a fungus on insect remains, I may also point out an incrustation caused by the bite of an acarus—one of a character very similar to that on the sugar-cane. On the young leaves of some eucalypti there are to be seen in great plenty white and red patches of a rugosity not coarser than an average sandpaper. On placing this diseased patch of gum leaf under the microscope, using the power of about 100, small yellowish conical mites will be seen here and there running over the ridges or hiding in the valleys between them. The young have four legs, the parent has eight. It is wonderful the amount of rough growth the plant forms in response to the irritation of this small acarus. Yet we need not wonder, when we consider the irritation produced by the bite of the acarus of the sheep scab, now so successfully eradicated by the regulations of this colony.

Ratoons grown up after a running fire had passed over a cane patch, I notice to have smooth glossy joints for some distance up, higher than this red incrustation appears, and, within the green sheathes, mites are to be found. From the Albert River I have received specimens of cane with an insect of the coccus genus hiding between the sheathes. It is as large as a sorghum seed, flesh coloured, covered with waxy powder, producing a numerous family which are visible to the naked eye, and run about quickly. They were found on some canes grown from joints newly imported from Singapore. This 'insect' appears to be the Pou blanc of the Mauritius, and, after the borer, is the next most injurious insect in that island, according to the author whose quotation follows:—"To free the canes before planting from insects that infest them, they are plunged from ten to twelve hours in a mixture of phénique, or carbolic acid and water; an infallible remedy."—*Sub-tropical Rambles* by Nicholas Pike, American Consul to the Mauritius, p. 496. The proportion of acid is not mentioned. The young of this insect are very active, and from an affected cane brought me by Mr. Geo. Black they travelled all over my consulting-room, drowning themselves by hundreds in glasses of water on the mantel shelf. This, I fear, is a real enemy to the sugar planter, and one that every effort should be made to eradicate. This circumstance also

points out the importance of careful inspection of sugar canes and other plants by competent observers before distribution to gardeners and planters. The hiding place of the young *Pou blanc*, or white louse, I have noticed within the *eyes* of the cane, under the dry outer husk of which these insects pack themselves in great numbers. From this fact the necessity of prolonged steeping may be seen. The canes that I treated with the lime dip were, with one exception, cleared of the mite. In future I would advise a prolonged immersion in the milk of lime, after carefully trashing the joint. Lower joints, too, are more likely to be free from the mite than upper ones. I notice the mite battles bravely in the lime for a long time before he dies, and other dips are worth consideration. It would be very imprudent to plant joints obtained from any fields where white louse has been observed. I have to thank Pilot Markham for specimens of canes from Moreton Island, quite free from *acarus* or other disease. To these canes I referred in my last paper. The joints were obtained from one of the South Sea traders, and have grown two seasons at the Pilot Station.

I am now steeping canes before planting in common carbolic acid and water, letting them remain in the mixture twenty-four hours. I have not decided what the proper strength should be, but recommend 1 lb. of acid to 100 gallons of water. I feel great confidence in asserting that all the varieties of sugar-cane, Bourbon included, can be grown free from the so-called rust by cleansing the cane joints, using suitable dips to destroy insects and mites, and by avoiding the proximity of old cane patches.

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### FROZEN CANES.

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Accidents are varied by the circumstances which conduce to their occurrence, and the history of the manufacture of sugar from the juice of the cane supplies no exception to this rule. In the previous number of *The Sugar Cane* we had a highly interesting description of the overtaking of the routine of the boiling-house by frost. It is a major impediment, the study of which may help to explain many

of the minor impediments of almost daily occurrence; we may thus learn something from its teachings, and from the "twenty-seven years" of experience, which so opportunely illustrates the difficulties, but without sufficiently overcoming them.

We may accept Mr. Ker's public statement of facts, for they are in the main corroborated by the experience of others. Some of his most interesting facts may be gathered from an argument on another branch of the subject. He says "If canes which had "been frozen solid, made good sugar in large quantity seventy "days after \* \* and if cane put up for seed in October has "been known (not unfrequently) to make sugar in the following "March, do I go too far in asserting my belief that cane properly "windrowed, will make sugar after ninety days." A somewhat parallel case occurred where canes that had been thrown down from time to time by rats, were collected for a challenge to make sugar with their juice. In a previous number of this Magazine we saw Mr. Mune recording the fact in *The Queenslander*, that he got 1½lb. of sugar per gallon of the juice of canes, two-thirds of those canes were already stale and sour, owing to the delay after cutting them, added to the time occupied in transit by water. The common usage is to grind the canes the same day that they are cut, thereby intending to avoid the acidity of fermentation, which so often embarrasses the best efforts to save the sugar.

Of course there was sugar in the juice of those canes, and it is important to bear in mind that that juice was not merely sugar and water. In fact, whatever the juice contained more than sugar and water were positive antagonistic impurities. Suppose we take one of those well known impurities for a sample. Let it be starch. Now starch is composed of carbon, oxygen, and hydrogen; and so is sugar! They simply differ in the proportion in which those elements combine. This power of combination however, is but feeble, and the arrangement is easily disarranged. New combinations occur when this bond is broken, and sugar suffers; for fermentation instantly begins, and sugar is, so to say, its food, and the starch becomes a ferment. It will be perfectly clear that if these antagonisms, which are natural in the cane, were free to



act therein, we might withhold our assent from Mr. Ker's proposition to "make sugar ninety days after cutting the cane," nor should we be likely to place any confidence in the facts which he adduces, that he "made good sugar in large quantities after seventy days, "from canes which had been frozen solid." In point of fact the best canes might give glucose, but nothing better at any time. We may, however, accept such facts most readily, when we know that they are not isolated facts, which lead us to understand the greater fact that the contained sugar remained undecomposed, unaffected even by frost and time combined. In fact, although those canes were "frozen solid," their contents must have remained in about the same relation to each other. Break or bruise the cane, or crush it in the mill, then the shattered walls of that cellular structure can no longer keep the contained antagonisms apart. Fermentation is now all but instantaneous. It ramifies and progresses to total acidity, prompt, at the expense of sugar. This fermentation and its results are modified in character by the surroundings and by temperature.

This reaction has been extensively and closely studied by able, well qualified men, as Desfosse, François, Braconnot, Kircher, and MacLagan, Frémy, Pasteur, and many more. Their great analytical experience, if added to the long practical experience of Mr. Ker and others, may help us to understand our subject to the extent of our acquaintance with their labours. We can take but a cursory glance at two or three matters of import before we find that theory is, after all, but well understood and well arranged practice.

There is a very useful axiom among physicians, which runs thus, "a correct diagnosis is half a cure," unless we know what we are doing we are like the mariner at sea without rudder or compass, or, to change the figure, like a blind man driving nails—hit or miss.

Fermentation, then, is the great destroyer of sugar with which we have to contend, enormous loss of sugar is the daily consequence, and molasses is the sure index. Such are the simple facts. The result of practical experience with canes that have not been frosted, as well as those canes that have been frosted, can aid the ventilation of this subject, which has a wide, an every day application.

What are those things which we desire to control, and how do they act in relation to the subject before us? There are three or four ingredients of cane-juice which are of sufficient importance to deserve our consideration here, because they are sufficient to produce all the ills complained of.

Besides water, we find sugar, starch (amylaceous matter), albumen, zymas, &c. These are stored in separate divisions of the cellular sugar-cane as so many reservoirs of food, and the preparer of this food. The food has to be prepared—say digested—before it can become suitable, fit to ramify through the sap vessels. The soluble ferment “zymas” is always sufficiently near to accomplish this change, as nature requires, when sugar becomes glucose instantaneously on contact, and starch is passed from the granular and albumen is already in the liquid state. We may now see clearly that when we crush the cane in the mill all these come in confusion together, and the now mischievous ferment is let loose there, to begin the work of destruction. It first acts on the starch by dissolving those granules into the fluid state, and starch now also becomes a ferment in the presence of albumen. Sugar is split up into glucose to become the food of this fermentation, until vinegar is the ultimate result, or until the progress of destruction is arrested. It follows, that the proper time to arrest this fermentation must be as soon as these antagonisms are brought together, that is, in the mill, where destruction begins.

It is also perfectly clear that if we allow time for fermentation to pervade the mixture, now cane-juice, we must expect to be annoyed in proportion to the length of this time, (to be reckoned by minutes, if not seconds,) by one or more of the organic acids, and by molasses in exchange for the sugar that was in the cane-juice. The vulgar error obtains in many quarters, that cane-juice is naturally acid, when we know that a naturally acid vegetable juice cannot crystallise, it can only produce glucose. This notion may have hastened Mr. Ker's old Si and others to pour “the blue bucketful of lime” so generously into the cane-juice. Some tell us the lime is to clarify the cane-juice, others that it is to correct the *natural acidity* of the juice, and a third party lays claim to both explanations and so

gets "between the two stools" in the eagerness to be right. Lime certainly can dissolve the starchy and the gummy matters to give the liquor a clearer appearance, which some call clarification, men who know that *no impurity had been removed by the lime, when lime was added, to become an obnoxious organic lime-salt thus laden with impurity*, as if designed to augment the immense sacrifice of sugar in molasses. Unfortunately it is not a difficult task to demonstrate the fact that some men lose as much sugar in the manufacture, as they sell. No doubt it is the promptitude with which fermentation begins, that has deceived them to the false conclusion that cane-juice is naturally acid.

We have glanced at one class of fermentation, the acetous. The other forms of fermentation are varied by the surroundings. We may hear of complaints of "ropiness" in the sugar, and it is attributed to some peculiarity of the weather, or the soil, or whatever imagination can suggest, which can also as satisfactorily explain the "sticky" character of the sugar, the slowness with which it crystallises in imperfect crystals, that it is difficult to work in the centrifugals, although he "has not begrudged lime," his remedy for every thing. He hesitates to believe that an organic lime-salt, laden with impurity, was the cause of his anxieties.

In ordinary solutions of sugar in water we may see the viscous, the lactic, and the butyric fermentations appear in succession. In cane-juice however, the transformation receives such an impetus from the associated impurities, as cause it to rush through these intermediate stages, and even the vinous and alcoholic stages of fermentation are passed into the ultimate acetous stage, producing vinegar, and is consistent with every day practice. It is not inconsistent with the facts to suggest the possibility of the progress of this fermentation being arrested at some one of these intermediate stages, if not at the first, then at the viscous stage, for example.

That indefatigable, and most distinguished labourer in this field of investigation M. Pasteur, tells us that the viscous fermentation can transform cane-sugar into a kind of gum or dextrin, mannite, and carbon dioxide. He also says that this gum is more allied by its characters to dextrine, a ferment, than to gum arabic, and that

white wines are more subject to this change called "ropiness" than red wines. He adds that the conditions of action necessary to these gummy ferments are the same as those which suit alcoholic ferment.

He has attributed ropiness to a fermentation peculiar to a previous decay in the vegetable. It seems to point to the original cut which severed the cane from its roots, and time had induced and perfected this decay there.

We see this idea was happily carried out into practice, when the cut canes were awaiting the opportunity for transit to Mr. Mune's mill; their cut ends were burnt to impede the progress of decay.

The researches of M. Fremy and M. Boutron, as well as those of M. Pelouze and M. Gâlis, when investigating the lactic fermentation, ascertained the best conditions for effecting the rapid transformation of sugar into lactic acid. The lactic fermentation requires the presence of nitrogenous albuminoid matter—precisely that which is already one of the impurities in every cane-juice. This fermentation can only continue if the degree of acidity of the liquor be kept from exceeding certain limits. The end is best obtained by saturating the liquor from time to time with chalk, or lime sufficient to neutralize all the acid which can be formed at the expense of sugar. Here we have at once the confirmation of Mr. Ker's great experience when he allows the acid present to predominate until he "comes out at the end with a neutral composition in which neither acid nor base will predominate; aim at this, and then do it," he thus arrests this lactic fermentation.

Accident can afford more stale canes than the planter can consent to part with gratuitously. His common remedy, lime, is of very questionable value. What are the facts?

The sugar in those canes remains, and so do the seeds of destruction, and many of them have been multiplied and ripened by time into a state of active maturity.

If those seeds of destruction could have so operated as to produce any effect beyond their own locality, all the sugar must have become vinegar in the cane, and Mr. Ker could not have realised any sugar from those frozen or any other canes. On the contrary, he got good sugar from them. Again; stale, rat-gnawed canes, that had been

thrown down from time to time, were gleaned for a challenge ; and a well crystallised sugar was got from their juice, and 25 per cent. more than from the best canes of that same field. Of course there was acid in those stale canes, but it was confined to the locality of the cut or bruise. If the cane be cut off—at the mill—above the knot next to the cut or bruise, where fermentation may be rife,\* the sugar that may be in the remainder of the cane will be found as when originally cut in the field, if not improved, provided the cane remains sound and dry ; and the juice when expressed be properly clarified, when denying it the opportunity for fermentation. Again, we are disposed to endorse Mr. Ker's experience when he says, " In no process continuous from the mill to the drying room " is the quality of the sugar materially improved *if approximate perfection be not attained in the handling of the raw juice. It must be properly treated, ab initio.*" There can be no doubt that the proper time for interrupting the fermentation of cane-juice is *before it leaves the mill.* It may begin then in moderation to accumulate in force, by the repetition even of weakness, before the juice reaches the pans. No lime should be used, unless to correct any accidental acidity, sufficient, but no more, when clarification is complete. This treatment of cane-juice, however it may be carried out into practice, appears to be the most consistent way out of the difficulties which so frequently surround the planter who aims at a suitable result for capital and labour. There can be no doubt that where the common, enormous loss of sugar by fermentation is avoided, a much larger sugar product is the result. So also neither frozen canes, nor stale canes, nor immature canes need be altogether lost if properly treated, and the juice promptly freed from impurities, as Mr. Ker also advises, whilst the juice is in the "raw" state, and not boil purity and impurity together, in the vain expectation of getting a pure sugar without loss of sugar.

W. EATHORNE GILL.

*South Hill Park, Hampstead.*

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\*This idea may also apply to immature canes, which necessity compels to cut. They could be laid or stand on a dry piece of ground exposed to the sun, say 8 or 10 days, to ripen the starch into sugar. Other canes grown rank in wet ground, could be similarly treated with beneficial results.

## TABLE OF EXPORTS OF SUGAR AND MOLASSES FROM THE HAWAIIAN ISLANDS,

(Continued from Vol. 5, pp. 609, 610),

By THOMAS G. THURM, Honolulu.

	1873.	1874.	1875.	1876.	1877.
Sugar.....lbs.	23,129,101	24,566,611	25,080,182	26,072,429	25,575,965
Molasses .....galls.	146,459	90,060	93,722	139,073	151,462

Table showing to what Countries the above has been exported.

Year.	PACIFIC PORTS, U.S.		ATLANTIC PORTS U.S.		BRITISH COLUMBIA.		NEW ZEALAND AND AUSTRALIA.		PACIFIC ISLANDS.		ALL OTHER PORTS.	
	Sugar.	Molasses.	Sugar.	Mol.	Sugar.	Molasses.	Sugar.	Mol.	Sugar.	Molasses.	Sugar.	Molasses.
	lbs.	galls.	lbs.	galls.	lbs.	galls.	lbs.	galls.	lbs.	galls.	lbs.	galls.
1873	14,757,614	115,874	70,699	1,269	1,270,102	18,928	7,013,946	6,603	990	1,520	15,750	2,265
1874	18,132,244	67,928	60,996	..	1,285,183	7,240	4,945,647	5,076	67,986	9,810	74,555	..
1875	23,694,977	66,990	67,767	...	372,517	12,974	846,166	..	86,576	..	12,179	3,997
1876	25,000,390	118,377	1,007	144	1,003,330	15,839	55,880	2,215	6,572	2,198	5,250	300
1877	25,506,025	101,926	453	9,917	12,561	27,353	703	2,100	52,733	3,035	3,490	7,131

## FOREIGN NOTES.

*“Journal des Fabricants de Sucre.”*

The sugar industry seems to be but moderately represented at the Exhibition. Among the apparatus, the show is neither very varied nor large. There are several fine cane mills of great power, triple effets, pans, pulpers and turbines; a manuel press, Lallouette's filtering *presse à caisse*, continual presses of different makes, and very fine char kilns and distillers' apparatus. The products shown are very fine, although a very large part of the case is devoted to sugars of *consommation directe*,—in crystals, tablets, cubes, &c., which shows how the public taste is changing, and that the process of refining and fabrication will need to undergo considerable modification. The *tendance* seems to lie to the refining in *fabrique*, and to the production of sugar in cubes, pieces, &c. The specimens exhibited prove the solution of the *industriel* question, and that, if the Government would lend themselves to it, there would be no difficulty in establishing rural refineries, which are the typical and definite organisation of the beetroot sugar in France. The root is really the first stage of the sugar, and its full treatment, from the extraction to the refining, can surely be performed with the greatest economy in the same place.

At the beginning of last week abundant rains fell in all the beet districts, and the weather has thus been unfavourable to sowing. It is estimated that a third of the crop will be sown since the 15th of May, and will probably not be finished till the 4th or 5th of June. The rising crop is good, but a deal of re-sowing and transplanting has to be done owing to the ravages of insects. The soil is very wet and dirty, making the dressing very difficult, and we may expect a very late and irregular crop. In the Nord the sowing is finished, and the crop on the whole is good. In the neighbourhood of Arras about two-sevenths of the sowing has yet to be done, and what has already been sown has suffered much from the ravages of all kinds of worms. The surface sown is from 15 to 20 per cent. above that of last year. From Magdebourg the news is not much better, although the temperature is now rising

along with a considerable cession of the east and south-western winds. About 145,514 arpents have been sown as against 138,084 last year, being an increase of  $5\frac{1}{2}$  per cent., but 8 per cent. will probably turn out to be nearer the mark. The weather in Hungary has changed for the worse, but the sowing has been finished, and thinning has even been commenced in several places. About 8 or 10 per cent. more has been sown. In Russia the night frosts have caused considerable damage, several of the *fabricants* along the Fastoff Railway having to re-sow large tracts. On the whole, however, and from the general conditions of the different countries, we can hardly look for a crop above the average.

In the Nord the operation of the last products of the fabrication is at present suspended owing to the bad state of the market.

From the official tables of the production, &c., of the *sucre indigènes*, made up to the 30th of May last, we find that in April the production was augmented to 3 millions kilos., which justifies the excellent quality of the root grown in 1877. The production of 1877-78, will, in the opinion of most optimists, exceed this, and we may expect 390 millions kilos. against 235 millions in 1876-77.

The general reunion of the German sugar *fabricants* took place on the 23rd, 24th, and 25th of May. During their sitting they proposed studying a number of very important questions relative to the culture, analyses, &c., of the beetroot.

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## INSTRUCTIONS CONCERNING THE CULTIVATION OF THE SUGAR BEET.

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We extract the following from the General Report of the Commissioner of Agriculture and Public Works of the Province of Quebec, for the year ending, June 30th, 1876:—

The most appropriate soil for the cultivation of wheat is that which must be chosen, in preference, for the sowing of sugar beets.

All rich, well-drained lands, containing a large proportion of pure clay, not exceeding sixty per cent., are considered as well adapted for the cultivation of the sugar beet. Sandy soils wholly without clay are not at all suited.



It is important that the beet should be sown as early as possible, so that it can profit by the spring rains to grow rapidly.

The soil must be deeply moulded so that the root can develop itself in the earth in place of running out of the soil; for all the portion exposed to the air and sun loses its saccharine qualities.

For the sake of the saccharine richness of the beet it is better that the land should be manured the year preceding the culture of the beet; for stall manure, especially green manure, imparts certain salts which greatly diminish the value of the juice and renders its extraction difficult. If the land has not been manured beforehand, it would be much better to sow the seed in good strong land well pulverized and drained. It is now a fact, shown by experience, that an excess of manure increases the weight but diminishes the richness in sugar.

It is very necessary to prepare the seed for germination, as it gains time; for this purpose it is steeped in liquid manure for twenty-four hours, then placed in heaps; as soon as the germs commence to appear it is ready for use. For a small sowing, in default of a mechanical sower, we take a wooden bar, say twelve feet long, in which are placed bolts of one inch in diameter, exceeding the face of the bar by two inches.

Two children, placed at each extremity, put the bar on the drill, bolt side down, and make as many holes as there are bolts, then the bar is brought to the last hole made, and so on to the end of the drill. The sower then follows and places two or three seeds in each hole. The sowing being complete, the roller is passed over the field. It is proper also to have the drills flat, and a space of at least sixteen inches must be left between each drill.

The first dressing or mellowing should be made when the seeds are noticed coming out of the ground; it is upon this operation, effected at a proper time and in a proper manner, that a portion of the success of the crop depends; it is done with a horse hoe, passing through the drills, or more simply with a hand hoe, as for potatoes; there remains then only the weeding between the beets in the drill to be done with the hand.

When the beets have attained a size of from  $\frac{1}{2}$  to  $\frac{3}{4}$  of an inch, the drills are thinned out leaving only one beet, the most vigorous,

at every nine inches, care being taken not to disturb it when upsetting the others; then those taken out are planted wherever there are blanks, a hole being previously made sufficiently deep, so that the root of the young plant will not be turned back on itself.

The second dressing or moulding is performed when the beet has three or five leaves.

Once the beet has grown sufficiently and its leaves cover the ground it kills the weeds.

The leaves must not be clipped from the beets, except when they are yellow; these are then given to the cattle.

The beet to be very rich in sugar must not exceed two pounds in weight.

The beets are taken up when fully ripened towards the middle of October. It is important that they should not be hurt nor broken when being taken up, for they quickly spoil. For this purpose a spade or two pronged fork is used; in large operations this work is done with a plough.

After the beets are taken up their leaves are taken off, either by breaking them with the hand or by cutting off the portion bearing the leaves with a knife.

The beets taken up should be placed in heaps and covered with leaves until placed in the pit.

One arpent of well cultivated land regularly planted as above shown gives 240 beets per row, and as there are 135 rows, when sixteen inches apart, 32,400 beets are obtained; by taking one pound as the average weight of each beet, this gives 32,400 pounds per arpent. Then there remains the pulp and the leaves which could be utilized for feeding cattle and which represent a nutritive value equal to at least one-fifth of the entire beet. In Belgium and France the average price of the beet is \$2 per thousand pounds, to which must be added an excise duty of \$2, which makes the cost \$4 per thousand pounds delivered to the factory. In 1873 a resolution was adopted in the Federal Parliament exempting the manufacture, in Canada, of beet root sugar from all excise duty during ten years. As long as this exemption lasts, it is evident

that the sugar industry should be advantageous to the cultivators of the beet, as well as the makers of the sugar.

If we now add to this the grant of \$7000 voted per year for ten years, by our legislature, to the first sugar factory established in this province; and, if, in addition, the beets from the seed distributed this year, give a satisfactory return both as regards quantity and quality, there is every reason to hope that next winter a company will be formed to work sugar beets.

Those who, by their intelligent labour and their care, shall have contributed to the success which the Government expects from this attempt at cultivation, will have the satisfaction of saying that they have a good share of the merit of having implanted in the country a wealth producing industry. With a great number we are certain that this praiseworthy ambition will have all the attraction of a reward proportionate to the efforts and sacrifices undergone by them.

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### THE NATURAL ADVANTAGES OF TROPICAL COUNTRIES.

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As agricultural producers, the tropical countries of the globe possess a great many advantages over those of the temperate and cold zones. Their productions are always wanted the world over, and by reason of the scarcity of labour since slavery was abolished in the majority of them, there is seldom an over-production. Some of their productions are altogether confined to them, such as sugar, coffee, cocoa, india-rubber, indigo, and most of the spices; and they have thus, so to say, the command of the world's markets. Indeed, instead of a tendency toward over-production, there is a gradual growing scarcity of their produce, consumption outstripping their supply by degrees, as has been exemplified during the past six years with respect to coffee. The same would have been noticeable for twenty years past as regards sugar production; but the enormous increase of the beet-root sugar industry in the temperate zone of Europe has counteracted the effect of a small supply of cane sugar.

The following will show how tropical productions are distributed on the earth :—

1. The equatorial zone, to  $15^{\circ}$  on both sides of the equator. In this division we shall find the Cape Verd Island, Sierra Leone, Ascension, and St. Helena, the Republic of Liberia, the European and Native settlements in the Gulf of Guinea; on the Western Coast of Africa; Abyssinia, Zanzibar on the East Coast; Mocha and Aden in the Red Sea; the northern portion of Madagascar, the Seychelles, the Madras Presidency, Northern India, Ceylon, and the Nicobar Islands, Sumatra, Siam, Malacca, Singapore, and the Straits Settlements, Cochin China, the Philippine Islands, Borneo, Celebes, and the Moluccas, Java and Madura, Banca, the Johore Archipelago, Timor, and the eastern group of islands, with New Guinea, a large portion of Northern Australia, the Marquesas, Society, and other oceanic islands. In South America, the Republics of Peru, Bolivia, Ecuador, Columbia, and Venezuela, British, French, and Dutch Guiana, and a large portion of the Empire of Brazil; Trinidad, Barbadoes, and most of the islands in the Caribbean Sea. The zone has a mean temperature of  $78\ 1\text{-}2$  to  $82\ 1\text{-}2$  Fahrenheit.

2. The tropical zone reaches from the  $15^{\circ}$  on each side of the equator to the tropics in  $23\text{ lat.}$  The mean temperature is  $73\ 1\text{-}2$  to  $78\ 3\text{-}4^{\circ}$ . Summer temperature,  $80\ 1\text{-}2$  to  $86^{\circ}$ ; winter temperature in the eastern coast districts,  $59^{\circ}$ .

In this region are comprised the following countries: Sandwich Isles, Canton, in province of China, Burmah, Calcutta, and a portion of the Bengal Presidency, the Bombay Presidency, Madagascar, Mauritius, and Bourbon; the southern portion of Brazil, Cuba, St. Domingo, Mexico, and Central America.

3. The sub-tropical zone extends from the tropics  $23^{\circ}$  to  $34^{\circ}$  of latitude. There are a number of tropical fruits in this region. The winters are mild, and vegetation is green throughout the year. In this division of the zone, palms and bananas grow on the plains; and in this region are comprised all the extreme northern portions of Africa, coasting the Mediterranean, comprising Algiers and the Barbary States, Egypt, part of Persia, Cabool, and the Punjaub;

the greater portion of China, Lower California, Texas, the South-Western States of America, the Bermudas, the Cape Colony and Natal, New South Wales, Southern and Western Australia; the Government settlements in the Northern Islands of New Zealand, the largest portion of Chili, Paraguay, Uruguay, and the Argentine Republic, the provinces of Brazil, from St. Paul to Rio Grande, Madeira, and the Canary Isles.

To define accurately the conditions of temperature which a plant requires to maintain it in a flourishing condition, we must ascertain within what limits its period of vegetation may vary, and what quantity of heat it requires. This most remarkable circumstance was first observed by Boussingault, but unfortunately we do not as yet possess sufficiently accurate accounts of the conditions of culture in the various regions of the earth, to enable us to follow out this ingenious view in all its details. His theory is, that the time required by a plant to arrive at maturity is as the inverse ratio of the temperature; therefore, knowing the mean temperature of any place, and the number of days which a plant takes to ripen, the time required at any other point more or less elevated can easily be ascertained. Peter Purry, a native of Switzerland, who settled in Charleston in the eighteenth century, in a memorial to the Duke of Newcastle, then Secretary of State, sets out with this postulate, that "there is a certain latitude on our globe, so happily tempered between the extremes of heat and cold, as to be more particularly adapted than any other for certain rich productions of the earth, among which are silk, cotton, indigo," etc.; and he fixes on the latitude of  $33^{\circ}$ , whether north or south, as the one of that peculiar character.

The following table, showing the climate, duration and production of certain plants cultivated in tropical America, is from the Proceedings of the Agricultural Society of Grenada. The second column gives the altitude in English yards above the level of the sea. The fifth, the number of plants in a Spanish "fanegada" of 170 varas, about 153 square yards. The sixth, the average duration of each plant. The seventh, the average produce of each plant in the year.

	Level of the Sea at	Mean. Temp. Deg. Min.	Time required.	Number of Plants.	Years.	Average Produce.
Cacao ( <i>Theobroma cacao</i> ) .....	587 yards.	81-17	6½ years.	1,156	40	1½ lb. per tree.
Plantain ( <i>Musa paradisiaca</i> ) .....	630 yds. to 1077	46-00 81-17 46-00 40-61	9 months. 9½ " " 11 " " 90 days.	3,613	30	50 plantains.
Indian Corn ( <i>Zea Mais</i> ) .....	1077 1260 to 1890 2880	81-17 40-61 36 to 37-80 25-20 to 27	110 " " 120 " " 180 " "	28,900	Annual.	238 for every seed planted.
Manioc or Cassava .....	1077 1195	81-17 40-61	10 months. 12 " "	28,900	Biennial.	One casava weighing ¾ lb. and ¼ oz. starch.
Cocoanut ( <i>Cocos nucifera</i> ) .....	630	43-00 81-17	120 days. 5 years.	452	60	4 bottles oil per tree.
Tobacco ( <i>Nicotiana tabacum</i> ) .....	630 1077 1980	46-00 81-17 46-00 40-61 33-30	150 days. 170 " " 180 " " 225 " "	28,900	Annual.	½ lb. dried to each 5 plants.
Cotton ( <i>Gossypium</i> ) .....	630 1077 1415	81-17 46-00 40-61 34-61	6½ months. 7 " " 7½ " " 9 " "	28,900	3½	½ lb. net per plant.
Coffee ( <i>Coffea Arabica</i> ) .....	230 630 1077 to 2250 2453	46 37-80 to 39-60 33-30	24 " " 25 " " 28 " " 36 " "	5,300	45	1½ lb. per tree.
Sugar-cane ( <i>Saccharum officinarum</i> ) .....	630 1080	84-17 46-00 41-40	11 " " 12 " " 14 " "	28,900	5	10 per cent. sugar upon the weight of the raw cane.
Indigo ( <i>Indigofera tinctoria</i> ) .....	90 630 1077	48-60 46-60 40-61	2½ " " 3 " " 3½ " "	57,800	1½	70 plants produce 11 lbs. colouring matter.
Potato ( <i>Solanum tuberosum</i> ) .....	1080 1980 2700	38-70 23-30 27-00	140 days. 165 " " 210 " "	116,000	Annual.	4½ lbs. each plant.
Wheat ( <i>Triticum aestivum</i> ) .....	567 1170 2520	42-30 38-70 32-99	80 " " 100 " " 120 " "	57,800	Annual.	37 for every seed planted.

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## AN APPEAL FROM THE BRISTOL OPERATIVE SUGAR REFINERS.

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Giant's Castle Hotel, Counterslip, Bristol, May, 1878.

*To the Sugar Refiners and Working Classes of the United Kingdom.*  
Fellow-Countrymen,

As members of the great army of British industry, we desire to place on public record our grievances in relation to the odious system now in operation in the principal countries of Europe—"of granting money bounties to the exporters of home-grown and refined sugar goods."

We desire to fully and freely discuss this important question, and we are sanguine that we shall be able to establish the justice of the cause for which we plead, viz.:—that those bounties should be withdrawn altogether by foreign Governments; failing that, that our own Government shall take such steps in the interests alike both of producers and consumers, as shall preclude the possibility, in the future, of this country being wholly placed at the mercy of the Continental supply.

As an illustration of the unfair and unjust competition which English manufacturers and workmen labour under, we cannot do better than point out the relations that foreign countries stand to with English refiners. In 1874, Austria granted out of the State no less a sum than £750,000 for the distribution of bounties to encourage the exportation of home sugars. France contributes £800,000, whilst Germany, Russia, Holland, Belgium, alike has contributed large sums from the State to encourage the development of the home sugar trade.

To show the gradual decline of the English sugar industry, it may be stated that in 1875 the total amount of foreign sugar imported into the United Kingdom amounted to 260,000 tons, whilst in 1877 it had reached a total of 320,529 tons, or an increase in two years of over 60,000 tons; whilst in the same space of time, in the port of Bristol alone, the decline in the importation of raw sugar amounted to 44,000 tons. This system has been the means of not only ruining the capitalist and refiner, but has also thrown thousands of honest English workmen, throughout the country,

into enforced idleness, and those dependent upon them in a state of semi-starvation, whilst our colonies, with every possible natural advantage for the cultivation of cane sugar, their trade has been nearly annihilated through this system adopted by Continental nations, of fostering the production and exportation of beetroot sugars. To point out how one branch of refining has become impossible to be successfully carried out in this country, it may be stated that it takes the labour of 70 men, one week, to manufacture 10,000 loaves and tittlers; the wages, at 25s. per week, amounting to £87 10s.; the weight of the loaves and tittlers would average 90 tons. The same amount of goods exported from France to this country would entitle the French refiners to £180, as a bonus of £2 per ton from the Government. In the case of German exported sugar goods, the bonus would be £270 upon 90 tons, or at the rate of £3 per ton for every ton exported from that country. Thus, not only does the foreign refiner obtain free gratis the labour of his workpeople, their wages being paid by the State in the shape of bounties, but he has also a large additional surplus placed to his credit, for the purpose of handicapping English refiners in their own markets. It must then be clear to all minds that the system of granting bounties by foreign Governments to exporters of sugar is a scandalous violation of all free trade principles, which debars fair competition, and which is hastening the destruction of an old and honourable branch of English industry, and, when accomplished, will fully bear out the declaration of Lord Derby, made in his place in Parliament, that when foreign refiners were masters of the situation, British consumers would then have to bear an increased price in the purchase of sugars.

Therefore, as operative sugar refiners, whose only inheritance is their labour, we raise our voice to protest against a continuance of this system, and we plead for the moral and practical co-operation of all sections of the British people in enabling us to carry our purpose to a successful issue.

Signed, on behalf of the Executive Committee,

AMOS DAWSON, Chairman. CHARLES FOX, Treasurer.

SAMUEL PETERS, Secretary,

Haversham House, Goodhind Street, Stapleton Road, Bristol.



## MONTHLY LIST OF PATENTS.

Communicated by GEORGE DAVIES, C.E., Patent Agent, 4, St. Ann's Square, Manchester.

## ENGLISH.

## APPLICATIONS.

1624. CHARLES DENTON ABEL, of 20, Southampton Buildings, Chancery Lane, Middlesex. *Improvements in apparatus employed in the manufacture of loaf or lump sugar.* A communication from Eugen Langen, of Cologne, Germany.

1703. WILLIAM ROBERT LAKE, of Southampton Buildings, Middlesex. *Improvements in the manufacture of sugar.* A communication from A. Zenisek and Dr. C. Schmidt, both of Dobrawic, Bohemia.

1904. JOHN FREDERICK COOKE FARQUHAR and JAMES BURNS MACFARLANE, both of 24 and 25, Long Acre, Middlesex. *Improvements in the treatment and purification of sugar.*

## ABRIDGEMENTS.

3749-77. JOHN SCHWARTZ, of Stepney, Middlesex. *Improvements in the manufacture of sugar.* The object of this invention is to treat white or crystallized sugar in such a manner as to impart a bloom or complexion thereto, that will improve its appearance and quality, and thereby increase its commercial value. To this end a solution of brown syrup or a solution of semi-uncrystallizable sugar is passed through the white or crystallized sugar either after it has undergone the ordinary refining process, or when it has been partially refined or during the refining process. This will impart to the crystallized sugar a rich lustrous bloom or complexion which will greatly improve its appearance and also its taste and will therefore add to its commercial value. When the solution of brown syrup or semi-uncrystallizable sugar has been prepared by diluting a sufficient quantity of the same in water so as to obtain the desired colour and density, the solution must be allowed to percolate through the mass of white or crystallized sugar which it is desired to operate upon; but it is preferable to carry on this process in a centrifugal machine, which will drive the solution through the mass of sugar without dissolving the same and will merely allow the coloured solution to impart the desired tint, colour, bloom, or complexion, by coating the crystals in an uniform manner.

3765-77. WILLIAM EDWARD NEWTON, of 66, Chancery Lane, Middlesex. *An improved method of refining sugar.* A communication from Edouard Merijot, of Paris. On leaving the boiling apparatus the saccharine mass is poured into moulds or frames of a peculiar construction in which it is allowed to cool and solidify. These moulds or frames are intended to be

filled with the concentrated syrup and placed in the turbine, and they are held in place by angle pieces or blocks. The moulds or forms are constructed of a strong metal framing or plate capable of resisting the pressure to which it is to be subjected, while two of the sides may be enclosed only by a woven or other fabric or metallic cloth or perforated metal. All the sides are slightly inclined in order to facilitate the subsequent discharge of the contents of the moulds, and the corners are rounded also to facilitate the delivery of the solid block of sugar. That side of the mould which fits against the side of the turbine is of less width than the opposite side, so that when the saccharine mass is subjected to the action of the centrifugal force it will have a tendency to approach the sides of the turbine; but being held or confined by the sides of the mould, it will become compressed, and without cracking or splitting as often occurs in other construction of apparatus. In order to fill the moulds they are placed on a bed made of wood covered with zinc, and the bottom of which is exactly the same curve as the under or curved part of mould; and the lateral sides of the bed also fit as exactly as possible the sides of the mould. At the end of from 18 to 24 hours the moulds may be removed and placed in the turbine, any superfluous sugar that may have run over the sides having been first removed. When the moulds have been properly secured in the turbine by means of wedges and covered in with a circular metal plate, the sugar is subjected for from forty to fifty minutes to the action of steam mixed with air, which may be blown into the central part of the apparatus through a kind of Giffard's injector. When the blocks have been sufficiently cleansed (which will be seen by examining the syrup which flows from the apparatus) the admission of the steam may be stopped; but the turbine should be kept in rotation in the air. This will dry and harden the blocks, which, when removed from the moulds, may be cut, sawn, or broken up after a short stoving.

4001-77. HENRY MEYER, of Bow, Middlesex. *An improvement in the process of manufacturing sugar.* The invention essentially consists in bleaching the saccharine liquor by means of sulphurous acid gas in vacuo, while the operation of concentrating the saccharine solution is being carried on. It is proposed to manufacture the sulphurous acid gas as the concentration of the saccharine solution is proceeding, and to introduce the gas directly into the vacuum pans so that these pans will become a substitute for the bleaching tanks. The cost of the tanks, and of the pumps or apparatus for pumping the gas into such tanks, is thus saved, and the labour necessary for carrying out the manufacture or refining of the sugar is proportionately economized, while the saccharine liquor is properly bleached. The vacuum or partial vacuum set up in the pans in the ordinary way is sufficient to draw in the gas, which will come by preference direct from the apparatus in which it is generated and purified. The sulphurous

acid gas may be introduced into the vacuum pan either intermittently or continuously until a sufficient charge thereof has been admitted. When the liquor in the vacuum pan has become bleached and sufficiently concentrated it is drawn off into tanks, and the process of manufacture will then proceed as heretofore.

## FRENCH.

121430. BERNARD, of Paris. *Vacuum extractors for sugar works, and for the treatment of fat bodies.*

121464. POSSOZ and LECUYER, of Paris. *Improvements in the manufacture of sugar.*

121478. LE BREF, of Paris. *Applying a special tissue for extracting beet-juice in continuous presses.*

121751. FOURNIER-LAIGNY and GUYOT, of Evron. *An apparatus for evaporating and concentrating fluids."*

121853. BOURDON. *Improvements in the treatment of various substances by the filter-press.*

121854. BOURDON. *Improvements in filter-presses.*

## CERTIFICATES OF ADDITION.

118953. LECOINDE and VILLETTE. *A preparatory press for beet-pulp and other semi-fluid substances.*

114348. TISSOT. *A continuous press-filter.*

## COLONIAL (NEW SOUTH WALES.)

JAMES DUNCAN (assignee of Moretz Weinrich). *Improvements in the treatment and purification of sugar and saccharine matters, and in the apparatus employed therein.*

## AMERICAN.

200780. HUGH W. WALKER and THOMAS L. PATTERSON, of Greenock, Scotland. *Improvements in flavoured syrups.* The object of the invention is to produce flavoured syrups or preserves for domestic use from the residual saccharine juices of sugar manufacture; and this object is attained in the following manner:—The saccharine juice is first treated by any of the well-known processes for rendering the final product uncrystallizable. For this purpose the syrup may be treated with sulphuric or other acid in the ordinary manner, but any of the methods known to sugar refiners may be employed for the purpose. The liquid is then neutralized and filtered, and, if desired, it may be clarified by chemical agents. The juice is next concentrated in the usual manner, and finally clarified. At any stage of the treatment of the sweet liquid or syrup, as described, the desired flavour or aroma is imparted to it by combining therewith the corresponding fruit-essence or essential oil, either obtained from fruit or flowers, or obtained artificially.

201110. JOHN GRISWOLD, of Fandon, Illinois. *Improvement in evaporating-pans.* This invention relates to evaporators for the manufacture of molasses and sugar from sorghum and other sugar-producing plants; and

consists essentially in the construction and arrangement of devices, by which the green, impure substance or scum is separated and removed from the juice, and in a cooling apparatus arranged to prevent the agitation of boiling from mixing the scum that has once risen with the juice again. The evaporating-pan is placed on the top of the furnace, and provided with a series of transverse partitions, which divide the pan into three chambers at the end immediately over the fire, and a series of chambers for the remainder of its length. The first named chambers are on one side extended a suitable distance beyond the side of the furnace, and at the outer end of each of these chambers the bottom forms inclines. The juice is fed into a box, and from the same extends a cooler under the projecting ends of the chambers. On the partitions dividing these chambers is placed a movable carriage, carrying a shaft, to which are attached three pairs or sets of spring arms for supporting the skimmers. These are made in the form of a pan, open at the front, and provided with perforated bottoms. From the back of each pan extends a T-shaped arm, which is placed between the spring arms, and the ends of these arms are bent outwards, and sprung into holes made in the side flanges of the skimmer. The two outer pairs of arms are, at their rear or inner ends, provided with counterbalancing weights, while the middle pair or set is by a rod connected with a pivotted lever for operating the skimmers. The skimmers are made of material so finely perforated that unbroken scum-cells will not pass through, while juice-cells will pass freely; and it is easy to perceive that the two will be separated if a proper place is provided for the scum to collect and rest without being broken up by the boiling process. Such a place is provided in this evaporator, by the cool juice constantly flowing beneath that portion outside the furnace in each of the three skimming-chambers or sections.

201229. ALBERT DE LA MONTAGNIE, of New York. *Improvement in machines for pressing sugar.* This invention relates to a machine for pressing sugar into cubes, and is, in its parts and their operation, an improvement on the sugar pressing machine patented to the inventor under letters patent No. 181920, and granted September 5, 1876. The invention consists in the combinations of devices whereby the entire action and operation of the machine is automatic, with the exception of the charging of the dies with sugar to be pressed, and the removal of the trays receiving the compressed cubes, and whereby a greater compactness and durability of the parts are secured. The block bearing the plungers, and forming part of the same, is fixed on the shaft, which has bearings in the frame. Upon this block, and fitted upon the plungers, are the dies. These dies are yoked together in opposite pairs. In the sides of the block are cut channels or grooves, and in these channels work tongues, which extends inward from the die frames upon either side. By means of these channels and tongues the dies are permitted to play upon the plungers, while, at the same time, the dies and their frames are rendered more steady in their movement on the plungers, and

are prevented from any lateral displacement on the block during the operation of the machine. To load or fill the dies, I employ the following devices:— Upon the frame, over the dies is mounted a hopper; within this hopper, on a shaft, works a cylinder: this cylinder is recessed on opposite sides of its shaft. The shaft is provided with a crank to turn it. A long tray is hinged upon the top of the frame, at one end, and it extends from its hinge to and under the hopper. Through an opening in the bottom of the tray, communication is had with the dies. A frame is arranged to slide longitudinally on the frame of the tray, and is provided with lateral partitions. In loading a set of dies, the cylinder is turned to the position, with one of its recesses opening into the receiving neck of the hopper. This recess is filled with sugar to be pressed, and the cylinder revolved to a reverse position, when the sugar which is of about sufficient quantity to load the dies is discharged into the tray, the frame being placed so as to have the charge delivered on to it. The frame is now moved to and over the dies, and is agitated quickly on the tray, and the dies are, by such operation, charged, and the upper surface of the sugar in the dies is smoothed off level with the top of the dies. The surplus sugar, if any remains, is now carried by the frame off from over the dies toward the hinge end of the tray, and the frame remains there during the next one-quarter revolution of the dies, and is brought into use again when the next set of dies is to be charged.

201809. FRANZ O. MATTHIEN, of Irvington, New York. *Improvement in processes for manufacturing coffee-sugar.* This improvement relates to the production of soft, or coffee-sugar, the particles of which are coated with syrup; and the process consists in manufacturing coffee-sugar by mixing, with a magma made in the ordinary way in a vacuum pan, but subjected to a long boiling in vacuo until it contains say, only about nine per cent. of moisture, a drier sugar or a dry powdered white sugar, or both, until the resulting product is made to contain only the quantity of moisture usually present in coffee-sugar.

### SUGAR STATISTICS—GREAT BRITAIN.

To MAY 18TH, 1878 AND 1877. IN THOUSANDS OF TONS, TO  
THE NEAREST THOUSAND.

	STOCKS.		IMPORTS.		DELIVERIES.	
	1878.	1877.	1878.	1877.	1878.	1877.
London . . . .	71	68	92	109	116	93
Liverpool ..	38	35	81	91	75	73
Bristol . . . .	3	4	17	18	17	16
Clyde . . . . .	57	40	112	106	94	84
Total ..	169	147	302	324	302	266
	Increase.. 21		Decrease.. 22		Increase.. 36	

STOCKS OF SUGAR IN THE CHIEF MARKETS OF THE WORLD ON THE  
1ST APRIL, FOR THREE YEARS, IN THOUSANDS OF  
TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
165	135	40	49	4	393	307	425

CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING  
1ST APRIL, IN THOUSANDS OF TONS.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
887	275	24	290	164	1640	1575	1630

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE,  
FOR THE ENSUING SEASON, COMPARED WITH THAT OF THE THREE  
PREVIOUS SEASONS.

(From Licht's Monthly Circular.)

	1877-78.	1876-77.	1875-76.	1874-75.
	Tons.	Tons.	Tons.	Tons.
France .....	385,000 ..	243,295 ..	462,259 ..	450,877
Germany (Zollverein)	370,000 ..	291,204 ..	346,646 ..	250,708
Austro-Hungary ....	250,000 ..	205,267 ..	180,138 ..	140,192
Russia and Poland ..	220,000 ..	250,000 ..	245,000 ..	222,500
Belgium .....	65,000 ..	44,467 ..	79,796 ..	71,079
Holland and other Countries.....	25,000 ..	25,000 ..	30,000 ..	30,000
Total.....	1,315,000	1,059,233	1,348,839	1,165,356

## STATE AND PROSPECTS OF THE SUGAR MARKET.

The Sugar Market during the past month has been dull, and prices of the finer descriptions of raw sugar have receded about 6d. per cwt., whilst useful refining kinds and Paris loaves must be quoted from 9d. to 1s. lower.

The excess of stocks on the 18th May, when compared with the same date in 1877, was about 21,000 tons, a similar comparison a month previously showing an excess at that time of about 35,600 tons.

Deliveries, which a month ago showed an excess over those of 1877 of about 39,500, do not show quite so large an excess. They were on the 18th May 35,400 in excess of those at that date in 1877; whilst the imports for the two years, which were about on a par last month, showed a decrease on the 18th May, as compared with 1877, of about 22,500 tons. So that prices have fallen in spite of statistics favourable, at any rate, to steady prices; and this fall must influence the supply by tending to curtail it,—at least so we should suppose.

The chief cause of this is the French bounty which continues to deluge the English market with refined at prices below cost. Refiners, to protect themselves, are forced, in face of all figures, to give less for their raw sugar, and the loss has consequently to be mainly borne by producers; but our so-called free-traders consider this advantageous to the consumer, as it is not thought essential that planters of sugar should have *any* profit in order to induce them to supply sugar. They have been impoverished for some years past, but must produce sugar even when ruined just as they are bound to breathe air. The new discovery made by "Free Trade" is that a *goose* which lays golden eggs *cannot* be killed, and that it will insist on continuing to do so *ad inf.* Only on this new theory can what would otherwise appear to be the blind folly of our legislature, in not dealing vigorously with French bounties, be intelligible, as governed by any principle which takes the future into account.

Present quotations of the standard qualities are as under:—  
Porto-Rico fair to good refining, 20s. 6d. to 21s., against 21s. 6d. to 22s.; good to fine grocery, 23s. to 25s., against 23s. 6d. to 25s.; Martinique crystals, 27s. to 27. 6d., against 27s. 6d. to 28s.; No. 12 Havana, 22s. 6d. to 23s., against 23s. 6d. to 24s.; fair to good refining Cuba Muscovados, 20s. 6d. to 21s., against 21s. 6d. to 22s.; middling to good brown Bahía, 18s. 6d. to 19s., against 19s. 6d. to 20s.; good to fine Pernambuco, 19s. to 20s., against 20s. to 20s. 6d.; Paris loaves, 27s. 6d. to 28s. 6d., against 28s. 6d. to 29s. 3d.

# THE SUGAR CANE.


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 The writers alone are responsible for their statements.

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## PROFESSOR FAWCETT ON THE SUGAR BOUNTY.

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In his new book on Free Trade and Protection, Professor Fawcett gives half a chapter to the subject of bounties on exports, taking the sugar bounty as his case in point. "It is," he says "the more desirable to consider this particular example, because at the present time this is by far the most important industry which receives a bounty." After explaining the nature and extent of the bounty given by the French Government on the exportation of refined sugar, he proceeds to point out how such a system must necessarily result in forcing down the price of the sugar exported, and that, consequently, the bounty "is really almost entirely spent in enabling the English people, and others who use French sugar, to enjoy the advantage of purchasing it considerably below cost price." He then argues that the effect on the country giving the bounty, and on the industry receiving it, must be the attraction of an excessive amount of capital to that particular industry, and a consequent eventual reduction in the profits, even perhaps below the average rate. "The only class, therefore, who can permanently profit from any particular produce being made artificially dear are those who own the land on which the produce is grown, and not those who either rent it, or those who use the produce as the raw material of some manufacture." In the case of sugar "the gain which is in this way secured by a special class is purchased at the expense of the entire French



nation." He sums up the case, as it effects the bounty-giving country, thus:—

"The chief results that are secured by the imposition of this onerous fine, are first, that more of the land, capital, and labour of France, are devoted to the growing of beetroot than would otherwise be the case, and the value of the land, suitable for the growth of beet root, is somewhat enhanced; secondly, that French sugar is sold at a lower rate in England and other countries, than it otherwise would be."

Professor Fawcett then proceeds to consider the matter in its relation to other countries, and to the competing industries which are not bounty-fed. Here we regret to find that the arguments used by our refiners and West India proprietors are not even referred to. Professor Fawcett contents himself with stating, in the space of a page and a half, his opinion that as long as France is willing to tax herself for our benefit we should not refuse to accept the advantage which is offered to us. The following is all he has to say on the subject:—

"It would certainly seem that we should be the last to complain if the French are willing thus to tax themselves for our benefit. The English sugar refiners have, however, repeatedly endeavoured to induce our Government to interpose on their behalf, and to protect them against French competition by imposing on French sugar an import duty, which would neutralize the effect of the bounty. Considerable injury is no doubt inflicted on English sugar refiners by the French being bribed by their Government to sell sugar in the English market at a price which without a State subvention would not prove remunerative. If, however, we once embark on the policy of protecting a special trade against the harm which may be done to it by some other country adopting an unwise fiscal policy, we should soon find ourselves involved in a labyrinth of commercial restrictions, and our tariff would become as protectionist as is the tariff of the most protectionist country. We occasionally hear of iron being imported into England from Belgium, and of cotton goods being sent to us from America. Our

ports are freely open to receive any quantity of these products which America or Belgium may be willing to send us; and yet our manufacturers find that they cannot export a single ton of iron to Belgium, or a single bale of cotton goods to the United States, without the payment of import duties. If, therefore, English sugar refiners were protected against the competition of cheap French sugar English iron-masters and English cotton manufacturers would be able to put forward an unanswerable claim to be secured against the competition of their foreign rivals. It usually happens that we, as a nation, obtain no compensating advantage for the injury which is done us by the protectionist tariffs of other countries. It can no doubt be shown that those who maintain these tariffs inflict a far greater injury upon themselves than they do upon us; but it cannot be denied that the English suffer, as a nation, by the commercial restrictions of other countries. When, however, the encouragement to home industry, which is supposed to be the main object of protection, is secured, not by imposing restraints on imports, but by granting bounties on exports, the loss which such a policy entails does not extend beyond the country which adopts it. England, as we have seen, gains, as certainly as France loses, by the bounty on French sugar; and as long as France is willing to tax herself for our benefit, why should we refuse to accept the advantage which is offered to us? We should be simply giving a new sanction to protection if the import of cheap sugar from France were impeded, with the view of causing such an advance in the price of sugar as would make the trade of sugar-refining in England adequately remunerative."

Our readers are sufficiently conversant with the arguments which have been advanced in refutation of this view of the case to be able to see at once how completely Professor Fawcett disregards them. The examination of his own arguments, if there be any, must form the subject of a second notice. In the meantime they are sufficiently answered in the following correspondence with *The Scotsman*.

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THE POLITICAL ECONOMY OF THE SUGAR QUESTION.

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We reproduce the following letters addressed by the Sugar Refiners' Committee to *The Scotsman*, on account of the editorial foot notes to each, which furnish a good instance of the kind of arguments and the confusion of ideas to which the simple word "protection" may give rise. We think,—and the refusal to publish Mr. Martineau's last letter rather tends to confirm that view,—that the Editor of *The Scotsman* has failed to establish his case.

## FOREIGN SUGAR BOUNTIES.

21, Mincing Lane, 25th May, 1878.

Sir,

My attention has been drawn to your leading article of the 17th inst. Will you permit me, with your accustomed readiness to state both sides of a question, to reply very briefly to your remarks in reference to the foreign export bounty question. Your arguments against protection in its accepted sense are I think unanswerable. The sugar trade do not ask for protection, but for free trade. At present the natural producers and manufacturers of sugar are compelled, by the operation of the foreign export bounty, to sell their produce below its natural free-trade value. The temporary benefit enjoyed by the consumer is procured at the expense of the natural producer no less than of the foreign taxpayer. This is not free-trade. A remedy which would restore natural conditions would not be protection.

Again, with respect to the consumer's interests, as Lord Derby stated most distinctly in the House of Lords, it is as much to his interest as to that of the producer that these foreign bounties should be stopped, since "any advantage of cheapness to the consumer which can be obtained by means of the bounty on foreign sugar will be temporary only." The Colonial Secretary fully admitted last week that "it is a very short-sighted policy for the consumer to desire the continuance of bounties, for when English colonial sugar is driven out of the market the price of foreign sugar will be raised, and the consumer will lose very largely."

These being the facts in regard to the producer on the one

hand and the consumer on the other, it is difficult to understand how the proposed remedy, which would simply retain the bounty for the benefit of the revenue, restore the natural sources of production to their normal condition, give sugar to the consumer at its free-trade value, and secure him against a certain prospect of future scarcity and monopoly prices, can be condemned as a return to protection.—I am, &c.

*Note by the Editor of The Scotsman.*

[Mr. Martineau does but repeat the fallacies which have been put forward by other interests to justify protection in their case. The sugar manufacturers have no burthen laid upon them by our law. If they cannot produce sugar as cheaply as it can be bought elsewhere, that is not a matter for the consideration of the consumers—that is, the great mass of the people. What they ask is that they should be protected against the competition of cheaper sugar than theirs; or, to put it in another way, they ask that the consumers of this country shall be compelled to pay more for their sugar in order that they (the manufacturers) may make a larger profit. The bogey of future dearness is not alarming.]

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31st May, 1878.

Sir,

I thank you for giving insertion to my letter, and hope you will do me the further favour of permitting me to reply very briefly to one remark in the note which you appended to it. I should not venture to ask this additional indulgence did I not think you disposed to give a staunch Liberal and Free-trader an opportunity of defending himself against what might appear a reflection on his orthodoxy.

I venture to think that further consideration will lead you to admit that I am not, as you now imagine, “repeating the fallacies which have been put forward by other interests to justify protection in their case.” Those interests, which are not affected by foreign export bounties, but which, nevertheless, complain of foreign competition and attribute their difficulties to the free admission of foreign products to this country coupled with the exclusion

of British products from foreign countries, base their argument on a diametrically opposite footing to mine. They propose, in effect, that as foreign countries refuse to procure their commodities where they are naturally produced most cheaply, we should retaliate by doing the same. The sugar producers, on the contrary, point out that foreign export bounties prevent us from procuring sugar where it is naturally produced most cheaply, and merely ask that the natural sources of production should have restored to them their full power of expansion. They maintain, and are supported by good authority, that this should be done in the interest of the consumer no less than in that of the producer. The fallacy of the one argument is manifest on the face of it, but I have not yet seen the fallacy of the other demonstrated. The question of degree of injury done to the natural producer or to the consumer does not affect the soundness of the argument.—I am, &c.

*Note by the Editor of The Scotsman.*

[If sugar cannot be “naturally” produced in one place as cheaply as it can be got in another, is it not something very like protection to put an import duty upon the cheaper sugar in order that what is “naturally” produced may be sold at a profit? The interest of the consumer as well as that of the producer was always insisted upon by Lord George Bentinck and the present Premier when they were upholding a duty on corn.]

7th June, 1878.

Sir,

In your second note on this subject, which I have been prevented from seeing till to-day, you ask a question, and I therefore venture a reply.

“To put an import duty upon the cheaper sugar in order that what is ‘naturally’ produced may be sold at a profit” is, I am quite ready to admit, very like protection. It is admitted that the artificially cheap sugar is checking the natural sources of production, and must eventually stop them. It is equally admitted that to desire the continuance of such a state of things is a very short-sighted policy for the consumer. To restore the natural

sources of production to their normal condition would therefore protect the consumer against an otherwise inevitable scarcity.

If, as you say, Lord George Bentinck and the present Premier always insisted on the interest of the consumer when upholding a duty on corn, they must have done so on principles exactly the opposite of ours, for they were upholding an artificially stimulated production against all comers, whereas we are defending the natural sources of production against the attacks of a protected industry. In doing so we are defending the consumer against a scarcity of sugar. If the word "protecting" be substituted for "defending," it does not affect the soundness of the argument, nor does it place us in the category of "protectionists" according to the conventional and accepted meaning of that expression. A hostile attack on the island of Jamaica would be resisted by our naval and military forces, but the Government would not therefore incur the imputation of having adopted a protectionist policy.—I am, &c.,

*Note by the Editor of The Scotsman.*

[What are the "natural sources" of production? Surely those where sugar can be most cheaply produced. If Mr. Martineau's "natural sources" cannot produce sugar as cheaply as it can be got elsewhere, that is evidence that they are not, in the economic sense, "natural sources." In truth, Mr. Martineau thinks, or appears to think, that he has changed a fact when he has only changed a name. The consumer is interested in getting sugar as cheaply as he can, and he knows that if a duty were put upon foreign sugar in order to increase the profits of home manufacturers—because that is what it comes to—the home manufacturers and growers would be "protected," though Mr. Martineau may prefer to call it "defended."]

To this note the following reply was sent, but the Editor "saw no necessity to print it":—

13th June, 1878.

Sir,

The answer to your question, What are the "natural sources" of production is very simple. They are those where sugar would naturally be produced if protection did not disturb the supply.

Your definition is only that of the cheapest sources of production ; which, in the case of sugar, happen to be the protected and therefore unnatural sources. It is manifestly unnatural that raw sugar should be sent from Java to Paris or New York to be refined for the supply of the English market ; yet such has been the case, owing to French and American bounties on the export of refined sugar. It is equally unnatural that bounty-fed beetroot sugar should go all the way from Austria to the United States to be refined. If there were no bounties, sugar would be produced where it can be grown cheapest, and refined where that operation can be carried on at least cost. It is exactly because production and manufacture have been diverted from their natural channels by artificial causes, which may cease at any moment, that there is a certainty, sooner or later, of a scarcity of sugar. We maintain, on economic grounds, that such a state of things should be remedied ; and we venture to think that an artificially stimulated source of production cannot, however cheap it may be, be called, "in the economic sense," a natural source.

I have pointed out, in a former letter, the reason why the consumer is not "interested in getting sugar as cheaply as he can," when he does so to the detriment of the future supply ; and I quoted the opinions of Lord Derby and Sir Michael Hicks-Beach in confirmation of that view. As to the producer, also, I am quite ready to use the word "protect" instead of "defend ;" all I ask is that the exact meaning of the word, as applied in this case, should be clearly understood. Protection, as distinguished from free trade, has always been understood to signify the stimulating of an industry by artificial means. We, on the contrary, ask to be protected against the hostile attack of an artificially stimulated industry ; and we show that that kind of protection should be accorded as much in the interests of the consumer as of the producer. The effect of export bounties is that producers and refiners, not bounty-fed, have frequently been compelled to produce and refine at a loss. The accounts of West India estates, and the fact that refineries here are often temporarily closed on account of working at a loss, are sufficient confirmation of this.

It is clear that whatever advantage is given to the consumer by the foreign bounty has also to be given to him by all other producers and refiners out of their own pockets. All we ask is that we should be relieved of this tax, and of the serious losses involved in occasional closing of our works when the level of cost price is passed. We venture to think that this will be admitted to be something different from demanding protection in order to increase our profits, as you put it.

The old system of stimulating an industry by protective duties was properly resisted in the interests of the consumer, who had a right to demand that he should be in no way hindered from enjoying the advantage of free trade. You now argue that, on the same principle, he should be allowed, even to his own ultimate detriment, to enjoy sugar below cost price, at the expense of the free trade producer no less than of the foreign tax-payer. I do not believe that such an argument can be supported on any principles, whether they be of justice, sound policy, or political economy.

In closing this discussion, I again thank you for permitting it to appear in your valuable columns.—I am, &c.

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#### BARBADOES.

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In Mr. Herbert's reply to the memorial of the 9th June, 1876, from proprietors of estates and others interested in Barbadoes, he makes the following observation on behalf of Lord Carnarvon, viz., that the constitution of Barbadoes "was designed to meet the requirements of a small community of white settlers owning slaves, and the sufficiency of which for the altered circumstances of a country now having a large population of free negroes is, as a matter of fact, now on trial." We can hardly suppose that so responsible an official as Mr. Herbert would make a statement for the purpose of exciting prejudice, and therefore we have felt it necessary to examine those interesting records of our early English settlements which exist in the archives of the State Paper



Office, with the view of ascertaining whether Mr. Herbert's statement is historically correct. Fortunately, documents exist which eliminate the question from the realms of mere opinion, and which demonstrate conclusively that the Government of our early English settlements, including Barbadoes, was not designed to meet "the requirements of a small community of white settlers owning slaves," but, on the contrary, was designed to preserve to English settlers, wherever they went, the rights and privileges inherent to them as citizens of England. The Charter granted by Queen Elizabeth to Sir Humphrey Gilbert, of Compton, Devonshire, dated 11th June, 1578, authorises the grantee to discover and take possession of all remote and barbarous lands unoccupied by any Christian prince or people, and vests in him the propriety of the soil, with reservation of one-fifth of gold and silver ore for Crown; and confers jurisdictions and royalties upon the grantee, with powers of government both executive and administrative, with the proviso "that all who settled" in the discovered countries "should have and enjoy all the privileges of free citizens and natives of England, any law, custom, or usage to the contrary notwithstanding." This Charter, which seems one of the earliest, clearly proves that English settlers were to suffer no loss of privileges, no *deminutio capitis*, in establishing colonies in the Western Hemisphere. Upon the accession of James I. no English colonies appear to have been established, and the only English dependencies then were the Channel Islands part of the Duchy of Normandy, and the Isle of Man. In that king's reign, the efforts of the enterprising pioneers of English civilisation began to bear fruits in settlements of English colonies on the other side of the Atlantic.

Stating shortly in chronological order the successive stages in the early settlement of Barbadoes, the following appeared to be the course of events:—

1605. An English vessel touched at the island, landed some men, who inscribed on a tree, "James, King of England, and of this Island." James I., it is stated, issued a warrant for a grant in favour of the Earl of Carlisle, of all the Carribean Islands, which he erected into a province under the name of Carliola, upon the

model of the palatinate of Durham. The king, however, appears to have already granted some rights over Barbadoes to the Earl of Marlborough, who accordingly raised opposition to the grant passing the Great Seal in Charles I. reign. After litigation, the Earl of Marlborough relinquished his right in consideration of an annuity to him and his heirs for ever of £300 a year.

Under the protection of the Earl of Marlborough, Sir William Courteen, a merchant of London, fitted out two vessels, one of which arrived in Barbadoes with settlers on the 17th February, 1625; the settlers landed, fortified themselves, and chose William Dean for their governor. In 1625, there appears from the state papers a commission to one Thomas Warner from the King, reciting the discovery of Barbadoes and other islands, and conferring powers of government on Warner as King's Lieutenant during royal pleasure. In 1626, Charles the First granted the Carribee Islands to the Earl of Carlisle, erecting them into a province, after a model of the palatinate of Durham. This grant, so far as it is now material to be stated, recites that the King had been requested to indue the region with certain privileges and jurisdictions and sound government belonging to the state of a colony; and after giving to and conferring on the Earl the whole region, and the propriety of the soil thereof, together with liberties and franchises, in consideration of an annual payment of £100 for ever, and other dues to the King, incorporated the region and islands adjacent into a province, and provided for the government of the islands and the enactment of laws, "*de et cum concilio assensu et approbatione liberorum tenentium ejusdem provincie vel majoris partis eorumdem.*"

The grant provided expressly that the laws so made should be agreeable, as near as conveniently might be, to the laws, statutes, customs, and rights of our Kingdom of England, and not repugnant thereunto or to reason; and further, that all subjects there should be as free as those that were born in England, and should possess all the liberties, privileges, and franchises of the Kingdom of England, them to use and enjoy, as liege people of England, without impediment, molestation, vexation, injury, or trouble of the

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king, his heirs, and successors. After sundry other provisions the Grant provided that the Crown "in no time to come should impose, or cause to be imposed, any imposition, custom, or tax whatsoever."

1628. It appears that in this year the Earl of Carlisle agreed with certain London merchants for the sale to them of 10,000 acres of land in Barbados under a government and governor of their own choosing. They accordingly despatched settlers under Charles Wolverston as governor, to whom the Earl gave a commission to be governor, commander, and captain over the settlers; and, upon the settlers landing in 1628, Wolverston chose a council, in pursuance of the directions received from the London merchants, the grantees from Lord Carlisle.

1645. From time to time, grants of land were made to settlers, and in 1645 it is said that the first assembly met at that date.

1651. Sir George Aysgue received the surrender of the island in behalf of the Parliament, on the terms stated in the charter of Barbados, the chief provisions of which were as follows:—

*Extracts from Charter of Barbados, 1652.*

"The Charter of Barbados, or Articles of Agreement, had, made, and concluded the 11th day of January, 1652, by and between the Commissioners of the Right Honourable the Lord Willoughby of Parham of the one part, and the Commissioners in the behalf of the Common-wealth of England of the other part, in order to the Rendition of the Island of Barbados.

"And are as followeth:—

"1. That a liberty of conscience in matters of religion be allowed to all, excepting such tenents as are inconsistent to a civil government; and that laws be put in execution against blasphemy, atheism, and open scandalous living, seditious preaching, or unsound doctrine sufficiently proved against him.

"3. That no taxes, customs, imports, loans, or excise shall be laid, nor levy made on any the inhabitants of this island without their consent in a General Assembly.

"4. That no man shall be imprisoned or put out of his possession of land and tenements which he has by any former warrant, or title derived from it, or other goods or chattels whatsoever,

without due proceedings according to the known laws of England, and statutes and customs of this island, in the courts of justice here first had, and judgement for the same obtained, and execution from thence awarded.

"5. That all suits between party and party, and criminal and common pleas be determined here, and none be compelled to go into England to assert or defend their titles to any estate which they have here, without the consent of the General Assembly.

"9. That all port-towns and cities under the Parliament's power shall be open unto the inhabitants of this island in as great a freedom of trade as ever, and that no companies be placed over them, nor the commodities of the island be ingrossed into private men's hands; and that all trade be free with all nations that do trade and are in amity with England.

"11. That all persons be free at any time to transport themselves and estates when they think fit, first setting up their names, according to the custom of this island.

"19. That the government of this island be by a Governor, Council and Assembly, according to the ancient and usual custom here: that the Governor be appointed by the States of England, and from time to time received and obeyed here, the Council be by him chosen, and an Assembly by a free and voluntary election of the freeholders of the island in the several parishes; and the usual custom of the choice of the Council be represented by the Commissioners to the Parliament of England, or to the Council of State established by authority of Parliament, with the desires of the inhabitants for the confirmation thereof for the future.

"20. And whereas it has been taken into serious consideration that the main and chief cause of our late troubles and miseries has grown by loose, base, and uncivil language, tending to sedition and derision, too commonly used among many people here: it is therefore further agreed that at the next General Assembly a strict law be made against all such persons, with a heavy penalty to be inflicted upon them that shall be guilty of any reviling speeches of what nature soever, by remembering or raveling into former differences, and reproaching any man with the cause he has formerly defended."

With respect to Mr. Herbert's observations as to the questionable validity of this charter, in consequence of its having been granted during the Protectorate, it must be borne in mind that its ratification by the Long Parliament was an executive act of State rather than of legislation, inasmuch as it embodies terms of capitulation for the rendition of the island by its royalist governor, Lord Willoughby, of Parham, to the parliamentary naval forces under Sir George Aysgue. It appears from the Journal of the House of Commons that on the 18th August, 1652, this charter was ratified by the Long Parliament. At that date the Long Parliament had, by the defeat of the royal forces at Worcester, established themselves as the *de facto* governing power of the realm. It appears, however, from the testimony of these early documents, that the first settlers by inherent right took with them, amongst other rights and liberties, a right to be governed in the country they settled and cultivated, as near as might be in accordance with the fundamental principles of government existing in England. And a reference to any one of the Royal Grants indicates that the Crown purported not so much to confer this right of government as to recognise it.

After the Restoration, serious questions arose between claimants under different Royal Grants; as against all such disputing grantees of the propriety of the soil, the settlers contended that they held their lands in fee, and were not tenants at will of Lord Carlisle or other royal grantee. The King procured the surrender to himself of all rights under Lord Carlisle's grant; and thereupon, in consideration of the inhabitants voting a perpetual subsidy of  $4\frac{1}{2}$  per cent. upon exports from the island, confirmed them in the possession of their lands, and released them from all royalties and dues alleged to be payable in respect of their tenure under the grant to Lord Carlisle. It would appear from other early documents that the King was finally invested with the rights of Lord Carlisle on the 25th of December, 1662, and in September of the following year the Local Act was passed, granting the  $4\frac{1}{2}$  per cent. duties. This Act recites the grant of King Charles the I. to the Earl of Carlisle. His then Majesty's purchase of that and all

rights by virtue of any other patent whatsoever. His taking the island into his royal protection, and Lord Willoughby's Commission as Governor, with a power confirming the titles of the inhabitants to their lands, &c.

King Charles II., it appears from the following extract from the Minutes of the Council of Barbados, under date 16th July, 1660, fully recognised the representative character of the form of government:—

*"Whereas, the Right Honble. the Councell of State, by authority of Parliament and by approbation of His Most Excellent Majesty King Charles II." [ &c. ], "have, by their Commission to me" [Thomas Moddiford] "granted, bearing date at Whitehall, the 24th April, 1660, amongst other things for the more orderly and peaceable government of this people of the island and their estates, given power and authority to myself and Councell, by and with the consent of the freeholders of this island, or their representatives, duly chosen according to the course and manner of election as hath been now used and practised. To make and ordaine such wholesome constitutions, ordinances, and by-laws, which are not repugnant to the laws of England, as to us shall seem meet, for the better, quiet, and peaceable government of this island, the people thereof, and their estates."*

It would appear, therefore, most clearly, from the early public records of the island, that the inhabitants possessed a form of government by Governor and Council, with legislative power vested in Governor, Council, and Representative Assembly; moreover, that such form of government was recognised as valid and subsisting by Charles I., the Commonwealth, and by Charles II. both before and after he had received the surrender of the rights of Lord Carlisle.

Although we have directed our attention in this paper chiefly to Barbados, the principles discussed are of interest to all colonies. There is nothing in the form of government existing in Barbados to justify such an assertion, which is historically inaccurate, on the part of Mr. Herbert, that "it was designed to meet the requirements of a small community of white settlers owning slaves." The present representative assembly can feel the

pulse of the people of Barbados, and especially of its labouring classes, infinitely better than any colonial officials, and it will be a bad day for the colony if it loses that legitimate control over its own affairs which is now exercised by the representative assembly under the present form of government. Once let it lose this control, and the colony will soon find out the truth of the view put forward by Bentham in the following quotation from his works :—

*“ The Sovereign, at two thousand leagues distance from his subjects, can be acquainted neither with their wants, their interests, their manners, nor their character. Their most legitimate and weighty complaints—weakened by reason of distance, stripped of everything which might excite sensibility, of everything which might soften or subdue the pride of power—are delivered without defence into the cabinet of the prince to the most insidious interpretations, to the most unfaithful representations. The colonists are still too happy if their demand of justice be not construed into a crime, and if their most moderate remonstrances are not punished as acts of rebellion. In a word, little is cared for their affection, nothing is feared for their resentment, and their despair is contemned. The most violent procedures are easily disguised under an appearance of necessity, and the best intentions will not always suffice to prevent the sacrifice of the public to private interests.”*

It thus appears that the form of government instituted in Barbados, and which still exists, is one belonging to the state of a colony of free settlers possessing English privileges, rights, and liberties. It has existed over 200 years. The Crown has full powers for all Imperial purposes of public defence, and the maintenance of law, and order, and power also to veto any legislative enactment at its discretion. To give the Crown more power would be unnecessary for any Imperial purpose, and to do so would be to derogate from the state of a colony of free settlers. The emancipation of the slaves was an act which rendered the form of government existing in Barbados, with its popular assembly elected by voters of all colours possessing the necessary franchise, more than ever appropriate to it as a colony of free settlers.

As regards the most unlikely possibility of the present or any other Secretary of State for the Colonies going to Parliament for powers to override the constitutional voice of the colony, and change the form of government against its will, we can only repeat what was said in the columns of this magazine last February:—

“No statesman or constitutional lawyer will deny the supreme authority of Parliament. At the same time, parliamentary usage shows that very exceptional circumstances are expected by Parliament to be placed on record before an Act is passed of direct legislation for a colony.”

“Lord Glenelg, when Secretary of State for the Colonies, in a despatch thus indicated the limits of parliamentary intervention:— ‘Parliamentary legislation, on any subject of exclusively internal concern to any British colony possessing a representative assembly, is, as a general rule, unconstitutional. It is a right of which the exercise is reserved for extreme cases, in which necessity at once creates and justifies the exception.’\* In a subsequent portion of the same despatch, Lord Glenelg intimates that the exercise of the supreme power of Parliament ought not to be called for, by the advisers of the Crown, upon a question, or in a constitutional conflict of opinion, which involved no urgent danger to the peace of society, and presented no insuperable impediment to the ordinary administration of public affairs.”

The Representative Assembly of Barbados, supplies the best index of the wants and necessities of the community, gives timely and sure warning of measures calculated to bring Crown and Colony into conflict, and thus affords a safeguard for peace and prosperity which no constitutional minister, having the interests of the colony at heart, can afford to despise.

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\* “The doctrine laid down in this passage is quoted with approval as an authority by Sir T. Erskine May, in his latest work on ‘Parliamentary Practice.’ With the exception of the Act suspending the constitution of Canada, at the time of the rebellion, and an Act suspending the constitution of Jamaica, in consequence of the Assembly withholding supplies and neglecting their function, we believe that every Act of Parliament dealing with the constitution of a colony recites the previous assent of the local legislature.”



TRAITÉ THÉORIQUE ET PRATIQUE DE LA FABRICATION DU SUCRE, COMPRENANT LA CULTURE DES PLANTES SACCHARINES, L'EXTRACTION DU SUCRE BRUT, LE RAFFINAGE, &c.

PAR DR. E. J. MAUMENÉ.

*(Continued from page 253.)*

The subject of analyses is treated of at great length, fully half the volume being devoted to its study. With regard to the determination of normal sugar,—this may be effected in two ways:—1st. By the optical methods, by means of the polariscope or saccharimeter; 2nd. By the chemical methods, by means of agents, the actions of which produce compounds of well defined composition. Before describing the saccharimetric process and apparatus, we give a short sketch of several details relative to the nature of this agent. It is a general hypothesis that the entire space of the universe is filled by a very ethereal medium, and that light is the result of certain vibratory or undulating movements excited in this medium; and also, that the particles of this ether, in ordinary light, vibrate in all directions, but in planes at right angles to the track of the ray. Now, ordinary light which is composed of seven different colored rays,—red, orange, yellow, green, blue, indigo, and violet,—falling upon any body is either reflected, refracted, or absorbed, and undergoes in certain circumstances a very curious modification to which the name polarisation has been given. In this polarised state the vibrations of ordinary light are reduced to vibrate in one particular plane, running perpendicular to the plane of vibration and called the plane of polarisation. Each of the above different coloured rays also undergoes this polarisation, but, as they differ in refrangibility, each has a distinct polarising angle. Of course all our readers are acquainted with the laws of reflection and refraction, as well as of the very remarkable phenomenon light undergoes in passing through a transparent body terminated by two non-parallel faces. The polarisation of light discovered by Malus, a French physicist, in 1810, may be thus explained. When a ray of light is

directed on a mirror lying at an angle of  $35^{\circ}25'$ , we get its maximum of reflection, but at the same time it undergoes a very remarkable modification, for, if the reflected ray be received on a second mirror, placed at the same angle— $35^{\circ}25'$ , we have again the maximum of reflection, but this reflection is diminished as the second plane is turned round longitudinally on its axis, and is extinguished completely when the two planes make between them a right angle. Or, in other words, when the two planes of reflection coincide, we get the maximum of reflection from each reflector; but if we turn the second reflector a quadrant, so as to make the planes of reflection perpendicular to one another, the second reflection is extinguished, but is again re-established on returning it, or by again turning it round another quadrant, so that the two images keep alternately appearing and disappearing from complete darkness to the luminosity of the primitive ray, and *vice versâ*, as we turn the second reflector longitudinally on its axis, and make the planes of reflection perpendicular or coincident to one another. In the double refraction which light undergoes in passing through all crystallizable bodies (except those of the cubic system), the ray is divided into two parts, both being polarised, the one ray being subject to the laws of simple refraction, remaining always in the plane of incidence and termed the *ordinary ray*, while the other, distinguished as the *extraordinary ray*, although also undergoing simple refraction, obeys other laws, as, in general, its planes of incidence and refraction only coincide when the plane of incidence passes the axis of the crystal. Take for example a piece of white paper on which a black dot has been made, and place on it a crystal of calcspar, and it will be seen that the image of the dot, in traversing the crystal, is divided, and the eye beholds two images instead of one. The ordinary ray or image which is polarised in the principle section of the crystal is easily distinguished, because, if we move the crystal round the paper, it will remain stationary, while the extraordinary image, polarised in a plane perpendicular to this section, appears to rotate round it. However, if we make the ray to traverse the crystal in a line parallel to its optic axis, double refraction does not take place, and we see only one image. When the two oppo-

sitely polarised rays<sup>a</sup> are made to fall on a reflector lying parallel to the principal section of the crystal, only the ordinary ray is reflected, while, on the other hand, we get the reflection of the extraordinary ray when those planes are at right angles to each other. As it is often necessary to get rid of one of these rays, we make use of the Nichol prism, which consists of two similar prisms of calespar cemented together with Canada balsam. The ray, directed on this prism, splits on entering, but when it reaches the balsam, which has a refraction between the ordinary and extraordinary rays, the ordinary ray is totally reflected, whilst the extraordinary passes on. Tourmaline also exhibits the same properties. In 1811, Arago discovered that polarised light passed perpendicularly through a thin plate of quartz, the faces of which had been cut perpendicular to the axis of the crystal, when reflected was coloured, and when the reflector was made to rotate, the different elementary rays of white light appeared, each being completely polarised. This is called circular polarisation, and was first made use of by Biot. The quartz causes the plane of polarisation to rotate through a certain angle, either to the right or left. Suppose a ray, polarised through a Nichol prism, be viewed through another such prism, having its principal section at right angles to the first, the field will appear black. But insert a plate of quartz between the two prisms, and the coloured rays will immediately appear, and if the prism which serves as the eyepiece be turned on its axis, the colours will go through the regular prismatic series. The crystal polarising the light is called the polariser, while that exhibiting the modification of the rays, the analyser, and from the above it is seen that the same crystals are used for the double object. The rotatory power of quartz is dependent on its crystalline structure. Its primitive form is a combination of the hexagonal prism with a double pyramid of six faces. At the angles of the prism, and at the beginning of each terminal pyramid are facets inclined all on one side, either to the right or left, and experiment shows that the quartz is either right or left handed according to the position of these facets, and this right or left power is exactly the same for the same thickness of quartz, the colours being dispersed in the same way. There are other bodies

which deviate the plane of polarisation to the right or left. Among the right handed are normal or cane sugar, grape sugar, &c., and on the left are fruit sugar, starch, &c. Bodies having this rotatory power preserve it when in a state of dissolution, if the dissolvent is itself inactive. Polarised light, when passed through a plate with parallel faces, of an bi-refrigent body, is again doubly refracted, but the ordinary and extraordinary rays cannot be isolated, and the analyzer cannot extinguish their ray in any position. Now, Biot has shown that the angle of deviation is always proportional to the length of the column of the liquid, and also to the quantity of the substance contained in a column of given length, or to the number of active particles through which the light has to pass. It is also dependent on the special rotatory power of the active element. If, then, the rotatory power be represented by  $R$ , the density of the active substance by  $d$ , the length of the tube of observation by  $l$ , we have for the angle  $A$  :—

$$A = R \times d \times l \text{ and } R = \frac{A}{ld}$$

and, in order to find the density, we divide the weight  $p$  by the volume  $v$ .

$$A = R \frac{p}{v} \times l = \frac{R pl}{v} \quad R = \frac{Av}{lp}$$

For example, the rotatory power of cane sugar  $R = 73.8^\circ$  (*tiente de passage*) ; a solution containing its weight of sugar  $p = 12.5^\circ$  in a volume  $v = 137$ cc, observed in a tube of 200 millimètres, will deviate the plane of polarization—

$$R = \frac{73.8^\circ \times 12.5 \times 200}{137} = 13.47^\circ$$

and the rotatory power is given by—

$$R = \frac{13.47^\circ \times 137}{200 \times 12.5} = 73.81^\circ$$

The rotatory power is modified by several causes, such as temperature, alkalies, &c. As regards the influence of temperature we cannot say much, as its action between  $10^\circ$  and  $30^\circ$  has never been taken into account. The chemical influences on rotation have received more attention. Bodenbender found that 1 part of lime destroyed

the rotating power of 1.12 parts of sugar; 1 part of baryta, .426 parts of sugar; 1 part of stroutia, .597 parts of sugar—one equivalent of each base destroying the power of the same quantity of sugar. Lime, also, according to Jodin, destroys the rotatory power of fruit-sugar. The dissolving agents exert also, even when inactive, a considerable action, as may be seen from the following experiments by Oudemans:—

	Inactive Dissolvant.	Pro- portion.	Rotatory Power.
Sugar .....	Water.....	.056 .....	66.9 ✓
„ .....	Alcohol c 50°	.050 .....	66.4 „
Brucine .....	Alcohol .....	.054 .....	85 ✓
„ .....	Chloroforme..	.019 .....	127 „

According to Jodin, alcohol considerably diminished the power of inverted sugar. Biot, in his experiments on polarisation, found that 16.471 grammes of sugar produced the same deviation in the plane of polarisation as a plate of quartz 1 millimètre thick. This weight of sugar is dissolved in 100 ccs of water, and observed in a tube of 200 millimètres long, so that in other words, a solution containing this proportion of sugar, and 200 times the thickness of the quartz produces the same rotation.

In 1849 Dubrunfaut proposed 16.39 as the weight, but in 1852 Clerget reduced it to 16.35, and this weight was universally used until lately, when it was again reduced, on the proposition of Dr. Maumené, according to the mean results by Broch, Luynes, and A. Girard. The mean of the results got by these experiments was 21.44°, equalling the weight of 16.15 grammes, and this is now considered as the correct amount. As regards the estimation of sugar by inversion, the results cannot be relied on, even in the case of pure sugar with which we can produce inversion with something like regularity; but it is especially unreliable when juice, raw sugar, &c., are treated in this way, not only on the account of the interference of foreign substances, but also owing to the great variability of inverted sugar. There are three polariscopes at present in use, the Soleil, or coloured polariscope, the Saccharimètre à Penombres, and the new polariscope by Laurent. In these instruments the principal parts are composed of the polariser, the tube

containing the sugar solution, and the analyser. The polariser in Soleil's polariscope is a double refracting prism, which breaks up the ray of light passing through the inlet, and, owing to the causes stated above, transmits only the ordinary ray. However, between this prism and the sugar solution, we have a plate of quartz which plays a very important part, and is called the double rotation plate. It is composed of two demi-discs of quartz, of equal thicknesses, the one being right and the other left handed. The light from this plate then passes through the sugar solution and falls on the compensator. Now the light when viewed through the analyser, before the introduction of the sugar tube, and without this compensator, would, of course, if the grand diagonal of the prism were horizontal, exhibit two coloured demi-discs of the same tint, but if the analyser be turned to the right one half the disc will incline to red, and the other to blue. It is on the identity of this tint that Soleil has based the working of his instrument. The equality of the tints being established if the sugar solution be introduced; we have a decided change on the face of the disc; its equality of tint is broken, and the intensity of the right-handed disc is deepened, just as when we turned the analyser to the right hands. Now to restore this uniformity of tint, we must turn the analyser so many degrees the other way, and if the solution has only a slight rotatory power, this method is satisfactory; but if, on the other hand, the rotatory power be considerable, we have the error arising from the difference in refrangibility of the coloured rays. However, whatever be the quantity of sugar turning to the right, it is always possible to neutralize its rotation by a proportionate thickness of left-handed quartz; and Soleil, in order to estimate exactly the quantity of sugar, and do away with the error of refrangibility, took advantage of this fact, and fitted to his instrument what he called a compensator. This compensator is composed of two systems of quartz with their rotatory powers opposed to one another. A plate of left-handed quartz is cut into two equal prisms, each of which is fixed in a brass frame, with a rack on the bottom, so that by means of a pinion, we are able to make them glide over one another either to the left or right. On the top of the one

lying next the solution is an ivory scale divided into per cents, while on the other frame is fixed an index, which glides over the scale and enables us to read the point of polarization. When the two prisms form a plate of equal thickness, (1 millimètre,) the index will stand at zero on the scale, which directly represents a hundredth of the millimètre of quartz, and indirectly, a hundredth of 16·15 grammes of sugar, as this weight, when dissolved in 100 of water, and observed, in a tube of 200 millimètres long, produces an equal rotation. If the solution is left-handed, however, this compensator would not work, and to remedy this, a plate of right-handed quartz, equal in thickness to the two prisms when standing at zero, is placed before the prism carrying the scale. When the index stands at zero, the two plates of quartz composing the compensator are equal, and their effect is neutral ; but if we now introduce the sugar-tube, the quartz disc is changed as before ; but in this case, by turning the pinion, working the sliding prisms of the compensator, so as to augment the thickness of the left-handed plate, we gradually neutralize the effects of the solution ; and when the equality of the tints are again established, we have only to read the thickness of the left-handed quartz in order to find the action of the solution. This reading is at once shown by the scale, which, as it is divided into hundredths, gives us at once, using of course 16·15 grammes in the case of sugar, the percentage of normal sugar contained in the solution. It often happens, that we have to polarize a solution from which all the colour cannot be taken, and which added to the colour produced by the polarization causes great *embarras* in the equalizing of the tint. This has been got over by what Soleil calls the "*producteur des teintes sensibles*." This is composed of a plate of quartz, perpendicular to the axis, of about six millimetres placed behind a double refracting prism, in front of the compensators, and this develops all the tints of the spectre, among which always exists one to neutralize the colour of the solution and produce the *teinte sensible*." This *teinte sensible*, is a grey blue, very like the colour of the flax flower. At the extremity of the instrument, in the part nearest the eye, there is a small Galileo glass, which moves backwards and forwards, and enables the operator to focus the view for himself.

The saccharimètre à Penombre is altogether simpler and more easily read than the apparatus of Soleil. In this instrument the double rotation plate produces, instead of colors, two penumbra, more or less near to a pure shadow, or to complete darkness. The principle of this instrument is due to Prof. Jellet, of Dublin, who, while experimenting with the nichol prism, discovered in 1860 the new prism which bears his name, and two or three years later brought it into practical use in saccharimetrie by producing a new polariscope, with which he proposed to obtain more exact results than those obtained by the instrument of Soleil. However, Jellet's apparatus never found much favour. It is to Cornu and Duboseq we are indebted for this beautiful instrument, the Saccharimètre à Penombre. These eminent physicists have modified and constructed the Jellet prism so as to get the very best results with it. The new instrument is composed, like that of Soleil, of three parts: the polariser, the solution tube, and the analyser. The Polariser is a bi-refrigent prism composed of three parts: the first is a lenticular glass, the curvity of which has for focus the point of the flame of a bunsen burner, in which, by means of a platinum wire, a small piece of sodium chloride is burning, giving rise to a yellow monochromatic flame; the second is a triangular prism of spath, cut in two, from each half of which an angle has been cut equal to  $2\cdot3^\circ$  and the two halves then drawn and joined together by means of terebenthene. This is the ingenious polariser of Jellet, the double planed polariser, analogous to the double rotation plates of Soleil. It is very easy to see that the light, directed through this prism, parallel to its axis, and received by a nichol analyser will be very nearly extinguished, and will be diminished in the same degree when the principal section of this analyser will be horizontal, and that the least movement of the analyser, either to the right or left of the vertical, will destroy the equality of the two penumbra produced. If the analyser be turned  $2\cdot5^\circ$  beyond the position marked for the left half, and if it is put at  $92\cdot30^\circ$  of the principal section of the left half, we lighten this half a little; but at the same time, we diminish the already feeble light of the right half, and this will bring the *presque obscurité* of the two halves to an absolute



equality, because both will be at  $87.3^\circ$  of the principal section of the analyser. A sugar solution can be examined between the two prisms, as between the double rotation plates of the Soleil and the compensator. The sugar solution turns the plane of polarisation a certain angle; but this angle is the same for the two halves of the Jellet prism, and the light which has traversed the polariser, and the solution tube, presents itself to the analyser in identical conditions. We can then judge of the deviation produced by the solution, not by means of the equality of two colours, but by the equality of the two penumbra. In their instrument the French physicists employ a nichol for the polariser instead of the spath. The analyser is an ordinary nichol, and the light employed is the monochromatic flame. The saccharimètre Laurent is a modification of the above instrument, and is, *par excellence*, the simplest and most correct of the three polariscopes. In it the Jellet prism is replaced by the ordinary polariser, behind which is placed a plate of gypsum (crystallised  $\text{CaOSO}_3(\text{HO}_2)$ ), so as to give to the analyser—which is the ordinary nichol—a yellow tint corresponding to the ray D of soda. With this plate Laurent only covers one of the halves of the diaphragme which contains it. From this it results that the light directed through this system can, if it is monochromatic, pass entirely when the two prisms, polariser and analyser, have their principal sections perpendicular, and gives the shade when the sections are parallel. In the saccharimètre à Penombre the angle is fixed, and shows only one shade of light, which sometimes gives rise to considerable difficulty in the readings; but Laurent in his instrument has overcome this difficulty. He remarked that the effects of the plate of gypsum changed with its position behind the polariser. If, then, the polariser be turned to a certain angle, the intensity of the light is augmented in both discs without destroying the equality of the two shades, and by this means we are able to compensate any particular shade of the solution under examination by turning the polariser to the angle best suited to preserve the maximum of the light. We may go, if necessary, up to the maximum angle of  $45^\circ$ . These angles are given by a graduation on the circle of the polariser, the

index being fixed to the diaphragme of the gypsum. With this instrument, also, we make use of the monochromatic flame. As the gas flame of the bunsen burner is blue, with a very little violet and green, the yellow developed in it by the sodium chloride flame is not quite pure; and Laurent, in order to get the true monochromatic flame, has added, at the inlet of his instrument and in front of the polariser, a thin sheet of bichromate of potash, which absorbs the blue, violet, and green rays, and allows only a pure monochromatic light to traverse the instrument. The polariser and the analyser, with the small Galileo glass, are the same as in the original instrument, but instead of the double rotation plates of quartz, we have a half-plate of gypsum, which does away with the compensator and the "*trente sensible*" prism. As a piece of mechanism the instrument is beautifully constructed, everything being done to make the readings and manipulation of the instrument as simple and precise as possible.

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### THE ART OF MANURING.

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The art of manuring, upon which so much of agricultural success depends at the present day, is yet, to a great extent, in its infancy, and will require still a considerable amount of intelligent observation before it can be ranked on a level with the accurate results of chemical science. It is, in fact, an application of physiology, a branch of science which follows closely in the steps of chemistry, but can never overtake them.

The difference between a manure and a stimulant does not appear to be well understood, though there is evidently the same difference between them as between food and medicine. The effects of the one are permanent, or extend over a considerable length of time; the effects of the other are ephemeral, and rarely extend beyond the period of one season. The full benefits of a manure will not, in general, be felt the first year; sometimes not for two, three

or more seasons ; and in Liebig's introduction to his "*Organic Chemistry*" will be found some instances in which six or seven years have elapsed before a soil has been able to recover its pristine fertility.

When, however, a thoroughly good manure is discovered, one that suits both the soil and the plant cultivated upon it—which is no very easy matter—then, in the course of a season or two, the land becomes remarkably prolific, the crops increase wonderfully, and the same thing continues for an indefinite period so long as this manure is applied in reasonable quantities and at short intervals. This is the case with complete manures, made with due care and containing all that the cultivated crop requires.

With a stimulant, on the other hand, such as sulphate of ammonia (the constant use of which is gradually exhausting the rich Demerara clays) or nitrate of soda, ingredients which form only a small portion of complete manures, the effect is immediately apparent (unless, indeed, the soil is already hopelessly barren), but next season nothing occurs.

Sometimes a manure that contains much organic matter will become matured by the air in the soil even when no plants are present to act upon it. Two plots of ground were treated with the same quantity of a good compound manure ; the one was planted, the other not. The planted plot showed no particular increase until the end of the second season, and the third season a splendid result ensued. The other plot received its plants at the beginning of the third season—that was in 1876, and gave at once a result equal to that of the first plot. With regard to cane, tobacco, coffee, and some other crops which require special care, we must not expect a wonderful result the first season—unless the plants are placed in a fertile virgin soil—in fact, if a large yield is obtained in the third season, and so on continuously, we have every reason to be satisfied. This is more especially the case when cheap manures, supplied to the soil with an economical hand, are in question. If the compound manure contains a large dose of stimulant, such as ammonia or nitrate, its effects will be at once apparent, but the ultimate result will often be disappointment, and unless due care and supervision be exercised the soil may be worse after a couple of crops than it was

before the application. This can only occur, however, by the use of deceptive manures, showing to analysis large amounts of nitrogen and little else. It is to be avoided by choosing a carefully made compound manure which appears most likely to suit the plant and the soil, and whose effects will be permanent.

If the soil is naturally poor, it is the only way of bringing it into a permanent state of fertility, and with the carefully made fertilizers manufactured at the present day in England, this should be achieved in the course of three or four years.

First, we must ascertain, as best we can, the requirements of the plant which is cultivated, and then the nature of the soil upon which it is, or intended to be, grown.

It is often said that wheat and cane require strong clay soils ; but excellent crops of both are raised on light soils ; in the West Indies on marly sands, as well as on clay, and in England on chalks and marls. The fact is that the clay supplies very easily the soluble silica which these plants of the grass tribe assimilate in large quantities ; but almost all soils will yield silica when properly cultivated. Then, clays usually contain a little ammonia, which is another advantage ; but chalks, on the other hand, will yield a little nitrate, and some sandy marls will show both. So there is no reason for the prejudice, and I think we may safely venture to assert that the same yield of produce may, at the present day, be obtained with soils of most descriptions, though, of course, some will require a longer treatment than others. Even the so-called barren moorlands can be effectually "reclaimed" by means of manures which supply in a proper form, the mineral salts in which these moorlands are deficient. This has recently been done in Holland and Germany, with truly surprising results. Now, what can be done for soils, which by nature are barren, at least as regards certain cultivated crops, can, of course, be effected for those which have become so by injudicious treatment and long working. In neither case can we expect any apparent result for three or four years. Three seasons is the time which, according to my own experience, is requisite for a manure to exert its full benefits. Instead of applying 30 cwt. in one year, 10 cwt. a year for three years is the proper practice, for the 30 cwt. employed the first year will give no more result than 10

cwt., and, being too high a dose, might, moreover, endanger the entire crop.

In chalky soils the various kinds of acid superphosphate may be used with advantage, provided they contain a due amount of nitrogen and alkaline salts, but in clays and sands deficient in lime, a manure which is too acid should be avoided, and in such soils "precipitated phosphate" with kainite and ammonia, together with a slight quantity only of soluble phosphate, will produce the most permanent results in any climate, and secure fertility under the most difficult of circumstances.

Nitrate of soda, as a source of nitrogen in compound manures, is to be preferred to sulphate of ammonia, except where the manure is obliged to contain much mineral salts to restore fertility; in which case there would be too great a predominance of alkaline salts,—the mixture would be apt to act as an antiseptic, and so prove prejudicial to the life of the young rootlets. Antiseptics stop the circulation of the sap in the cells of a plant as they arrest the movements of infusoria, and finally destroy the life of the cells. Hence the danger of too great an excess of sulphuric acid in some superphosphate manures carelessly made; free acid of this kind is more than an antiseptic, it is a caustic and an astringent at the same time. Hence, also the necessity of avoiding, in artificial manures, too large a dose of chlorides. These compounds are all more or less antiseptic. Those tracts of land in the South of France, covered with what is called '*salant*' on which vegetation is so rare, and which give miserable results when cultivated, owe their barrenness to the thin layer of salt (chloride of sodium) so frequently seen on the ground in the plains of Le Herault. When the ground is drained and frequent showers have carried off this layer of '*salant*' the soil becomes fertile.

It is well to recollect as regards the sugar-cane, that saccharose is made in the field rather than in the boiling-house, and that manure is a great help towards a large yield. But the kind of manure to be used on various soils is an important item of success, we must study the art of manuring, nor should our impatience lead us to expect great results all at once, even when the right kind of manure is found.

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BEET ROOT SUGAR DIFFUSION.

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The most modern, and (by many believed) the most effective process in this great industry is the process of diffusion. Like everything else which strikes at established customs, it has its ardent admirers and its detractors. The latter prefer to proceed with their old machinery; the former have adopted the new system greatly to their own profit, both in results and in the lessening of expenditure in establishing the manufactory.

The process admits of the use of dried roots as well as of green ones, and it thus extends the season, through which sugar can be made, to the whole year, instead of the few months between the times of the ripening of the roots, and the time towards the end of the season when they begin growing, and at which period all operations must cease,—the manufactory working the green roots as long as they do well, and then setting on to the dried roots; thus the operation of the factory is continuous instead of spasmodic, and the manufacturer is enabled to keep on his hands, instead of discharging them; and also to keep his utensils in good order. The machinery being continuous, is also much smaller, and as all presses and press operations are done away with, the amount of hand labour is greatly reduced.

The manufacturers who adopt this system commence their work with green roots, but at the same time the drying proceeds, this enables them to dispose of an immense mass of roots in far shorter time than they otherwise could, they thus secure the roots whilst they are in the most favourable condition,—for, as a matter of course, there is a considerable change working in the root from the time it is dug until it germinates in the spring,—and although during the winter the change is slow, yet it is certain and very appreciable. It enables them also to procure roots from a very considerable distance, if they are dried where grown.

We will now proceed to describe the two processes :—

The roots are sliced across, as thin as possible, not exceeding one twentieth of an inch, with a *very sharp* tool. This is very

important; when cut with a blunt tool the roots oxidize and turn dark, and the syrup is highly coloured; but when cut with a sharp tool no colouring of any consequence takes place. The sliced roots are then wetted with water of such a heat as to bring the mixture of roots and water to the heat of from  $125^{\circ}$  to  $130^{\circ}$  Fah. The original heat of the water, when the temperature of the sliced roots is from  $50^{\circ}$  to  $60^{\circ}$ , will be from  $160^{\circ}$  to  $170^{\circ}$  Fah. The roots should be shovelled into the diffusion vessels, and the water admitted at the same time, in proper proportion, so that the roots are not made too hot in any place. The water, when completely added, must be at such a heat as just to "wither" the roots, but by no means to scald or boil them; at the right heat the water extracts all the sugar of the roots, without extracting the albuminous and pectine portions of them; when the grating and pressing process is used, the juice extracted is of a much greater "specific gravity" than you obtain from green roots, but it owes this specific gravity in a great measure to the albumen and pectine which has been extracted, and which must all be got rid of in the subsequent defecation.

This water, at the above heat, remains on the sliced roots for half an hour; it is then drawn off again, heated up to the original heat of  $160^{\circ}$  to  $170^{\circ}$ , and added to a second vessel of the sliced roots,—the added liquor must bring the mixture to  $125^{\circ}$  to  $130^{\circ}$  of heat,—it is then drawn off, again heated, and added to a third vessel of roots,—the process being continued until you have brought the liquor to the strength you require, that is as near to the normal strength of the natural juice of the root as possible, for you need not expect to exceed this, generally five shifts are sufficient. Meantime, water is added to the first vessel, (the manufacturers say cold, but I prefer to keep the heat up to  $125^{\circ}$ ,) and it steeps for half an hour,—it is then drawn off again, heated up to such a heat as will keep the mash at  $125^{\circ}$ , and added to vessel No. 2,—then the same operation proceeds with No. 3, and finally with No. 4. Meantime No. 1 is subjected to fresh baths or washings of water, until the roots are entirely spent, and all the sweetness is extracted, when the vessel is emptied, and the roots go to the cattle trough. It will be seen in the description of the dried root process, that they add phosphoric

acid to the slices with the mashing water, which has an excellent effect on the juice in purifying it, and it also renders the food for the cattle far better, and the resulting manure far richer and more valuable. The way to make this phosphoric acid will be shown presently.

The liquor thus obtained is defecated with a small dose of lime and filtered, then carbonated and again filtered; it is then in a fit state to evaporate and bring down to crystallization point. If all has been well done, it crystallizes readily, and the result is then centrifugalled and refined in the ordinary manner.

The dried roots are treated exactly in the same manner only as you will find the dried roots swell, with the effect of the liquors added to them, to nearly their original volume. The diffusion vessels must not be much more than half-filled with dried roots,—the phosphoric acid must be added from the first operation,—by which the less defecation with lime is required.

We were told by those who brought these plans from Germany, that juice so prepared would not require to be treated with lime, but we do not believe this, and think from our limited experience, that lime will always be necessary.

The phosphoric acid is made by adding water to pure *superphosphate*; (not that mixed with salt and other chemicals,) the phosphoric acid then comes out in the supernatant liquor and is fit for use.

If you cannot get the superphosphate *pure* you must make it,—the sorts ordinarily used in agriculture must not be used, or the salt and other chemicals will be added to the juice, and you have quite enough of the “salines” in the natural juice to deal with, without adding more.

In dealing with the dried roots, you must bear in mind that they have shrunk to one-fifth of their original weight, and that they are fully half sugar. In the five or more operations and shiftings in the diffusion vessels, you will get the resulting liquor to a density from 20° to 25° Baume, and thus save a great deal in the evaporation, so that the expense of drying the roots is by no means lost.

In a future article we shall give the particulars of drying the roots.

With regard to defecation with lime, there is one thing to be



observed. In the first place do not allow the defecation juice to *boil* rapidly after the lime is added ; your so doing breaks up the flakes and renders filtration very difficult, keep the flakes as large as possible, and filtration becomes an easy matter.

Many people think that lime is "lime" and that all lime is alike ; there never was a greater mistake. Lime varies extremely in properties and qualities, and each kind of lime must meet with the treatment it requires,—some carbonates easily and appears in substance to be all alike,—other kinds, such as the lime made from blue limestone, varies greatly. It seems to consist of two different stones ; one carbonates readily, the other will be days about it and, of course, the syrup cannot wait about for that. Where this is the case the phosphoric acid comes in with excellent effect, and when boiled with the otherwise clear syrup throws down a very considerable deposit of what must be a phosphate of lime, most likely mixed with a sulphate, which must be filtered out.

In the blue limestone quarries, it is well known that there are layers of stone of different qualities, some of which are almost, if not quite, water lime, other layers are pure fat lime,—but the separation is troublesome, and in general a considerable mixture takes place ; this is of no consequence either for mortar or manure, but is of great importance and effect in sugar making.

Where you cannot get pure superphosphate that can be depended on,—collect the bones and burn them to ashes, saturate these bone ashes with sulphuric acid and water half and half, leave the mixture for some days, until the acid has had full time to amalgamate with the lime in the bones, and it has become a neutral mass ; then add water, the sulphate of lime formed from the lime in the bones will sink ; the phosphoric acid (which you want,) will be in the supernatant liquor and can be removed, adding water until you have got it all out of the bone ash mixture.

If you have exceeded in the sulphuric acid you will not have a pure phosphoric acid ; it is better to use too little than too much sulphuric acid ; you may thus waste some bone ashes, but that is only a small loss, and you get a far purer phosphoric acid.

E. L. C.

*Toronto, Ontario, Canada, May, 1878.*

## GRAPE SUGAR.

## A NEW AND IMPORTANT INDUSTRY.

A correspondent of the *American Grocer*, gives the following account of Messrs. Pierce & Jebb's, new building, in the city of Buffalo, for the manufacture of Grape sugar :—

We found a structure seven stories in height and covering a space of 80 by 200 feet, bearing every evidence of careful forethought, skill, and substantiality in its construction. Each of the seven floors is fitted up in the most elaborate manner to accommodate the enterprise which occupies it. Two immense boilers, 35 feet in length, and of 250 horse-power each, propel a beautiful engine of great capacity, and feed the miles and miles of pipes which carry heated water, steam, and warmth to all parts of the mammoth building. Two railway tracts enter the building, one leading to the New York Central for Eastern traffic, and the other tapping the Lake Shore and other roads. The Erie Canal runs immediately at the rear. Two large elevators extend from bottom to top of the building, capable of carrying up an almost incalculable amount of material. Great vats by the dozen are stationed at convenient points in every direction, in which are contained the products of the factory in the various conditions of manipulation. Whole floors are devoted to systems of zinc-lined conductor troughs, through which the material runs in the process of manufacture. And everywhere is seen the most perfect order, system, and labour-saving facility.

The corn, from which the sugar and syrup are obtained, is taken to the top floor of the building by the elevators direct from the cars, and is there crushed into pulp, after being cleansed of all impurities and extraneous matter. It then undergoes important chemical changes, which convert it into a gummy semi-liquid, and this, after being subjected to further vital processes and minute filtration, by intense steam power, into a patented contrivance, is changed again, by the subtleties of science unfamiliar to the writer, into a pure, limpid, thick syrup.

This is called glucose, or grape sugar, by the manufacturers, and

it is one of the most beautiful products of modern chemistry. It is much whiter than refined cane syrup, but less sweet; by a further process it is converted into starch sugar, or, as it is generally called by the trade, "grape sugar," a product which looks not unlike refined mutton tallow, or paraffine in cakes, and which, although not possessing sufficient saccharine properties to take the place of cane sugar for family use, is of the greatest utility for many manufacturing purposes. Brewers, tobaccoists, druggists, confectioners, vinegar makers, &c., use it freely. In the production of beer and malt liquors it is much preferred to ordinary sugar, as it adds certain elements of great value to the malt, which do not appear in cane syrup. The sugar is employed in the same way, and this form of the product is highly esteemed by confectioners, liquorice makers, &c. The delicious cream candy, which has recently been so popular, is largely composed of grape sugar, so that of this article it may be truly said that "children cry for it already."

Grape sugar and syrup are cheaper than the lowest grades of cane sugar and molasses can be produced for, and this fact will tend to largely increase their consumption. Considerable quantities of glucose are being used by wine growers, who are adopting it as the saccharine principle best fitted for their use, where grapes are deficient in this property,—the saccharine matter being in both instances nearly identical. The cordial makers of Copenhagen and elsewhere are also using it freely.

The factory, of which we are speaking, produces easily three hundred barrels of syrup or sugar, ready for market, *daily*, and these great facilities are taxed to their utmost capacity; so much so, indeed, that its work is uninterrupted, day or night, from one month's end to another. In quality, the goods produced here are very superior, while, in prices, they more than meet all competition.

This enterprise—employing more than a quarter of a million of dollars of capital, and affording remunerative labour to hundreds of workmen, is due to the energy and public spirit of two of the most useful and opulent citizens of Buffalo—Senator-elect Roy V. Pierce and T. A. Jebb, Esq. That their great work will prove amply profitable is not doubted by any who are familiar with it.

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CONTINENTAL NOTES.

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The weather in the beet districts has been very unfavourable, and is beginning to excite much uneasiness. Not only was the sowing very much retarded—the half of June being gone before the finish—but the dressing and transplanting, owing to the state of the ground, is very difficult to get on with. The beetroot last sown is well in leaf, but the roots, hardly yet set, cannot profit by this. In our last issue we stated the culture to be at least fifteen days to three weeks behind, and to day we have to report even a worse state of things. No matter how the weather may turn out for the future, a very slow and unequal crop can only be expected; the root also will be poor in sugar. We recollect that, if the May of last year resembled the May of this, the month of June, on the other hand, was very favourable; and we know that sugar commences to be formed in the plant as soon as it is in possession of its leaves. We know also that the quicker the leaves have grown, and the greater their number, the richer is the plant in sugar. This year the best time for this elaboration of the sugar in the plant will necessarily be restricted; and so, in addition to a light crop per acre, we have also the prospect of a very unfavourable yield of sugar; besides,—the acreage sown, although a little over that of last year, will hardly compensate, by its greater weight of roots, this first failure in the production of sugar.

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With regard to the production of the present season, we see, from the official tables, that to the 31st May it was 384,008,255 kilos., against 237,199,516 kilos. for last year, thus showing an increase of about 146,808,739 kilos., due almost entirely to the richness of the root in sugar. The exportation has been 83,161,317 kilos., against 8,721,923 kilos. in 1877. The sugar made, in course of *fabrication*, and in warehouse, at the same date, was 87,257,592 kilos., against 98,873,505 kilos. in 1877, which makes, notwithstanding the important production of the season, a decrease of 11,615,913 kilos.

At a meeting of the *fabricants* of The Aisne, held at St. Quentin, on the 18th May, M. Georges, the President, made the very important communication that the negotiations relative to the formation of a new International Sugar Convention, based on refining in bond, or on duty *à la consommation*, having fallen through, owing to the opposition of Holland, the project might be considered as definitely abandoned.

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The members of the Central Committee of *fabricants*, on receiving confirmation of this news from the Minister, have concluded that in this situation it would be best to substitute an actual *régime* as the proper remedy.

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The principal object of The Aisne meeting was to examine the general tariff of the Customs with regard to sugars. It was unanimously decided to demand that this new general tariff should deviate as little as possible from the dispositions of the actual tariff; that is to say, that foreign refined sugar, as well as foreign *prudres blanches*, should continue to be prohibited, and the Central Committee were requested to act in this sense.

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On the 23rd of May, the Belgian Chamber of Representatives received the report made by M. Meeus, in the name of the permanent commission of the sugar industry, on the subject of the compensative laws to be established on foreign sugars imported into the country. About a year ago, several of the *fabricants* tried to obtain this surtax from the Chamber,—the demand being founded on the competition of the foreign sugars favoured by bounties on exportation—*primes d'exportation*—and this was justified, said M. Meeus, by the existence of these surtaxes before the Convention of 1864, and by their being established in France, immediately the Convention lapsed. The report finished by requesting the return of the petition of the *fabricants* to the Minister of Finance, with the prayer to make it law. The petition was returned to the Minister, who is to consider the question. W. Schoeffer & Co., of Rotterdam, have

published a *memoire* on the subject, in which the situation is examined at great length. The author concludes in favour of the tax on richness, which could be done by refining in bond; and for the beetroot sugar produced in the country, he proposes to proportion the tax to the richness of the root. The tax by degree of richness, adds the author, is easy to apply, considering that the sale of sugars is made, in all beet producing countries, on an analogous scale; that is to say, according to the saccharine richness of the product.

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On the 27th May, M. Faure, placed before the Chamber of Deputies, in the name of the sixth initiative parliamentary commission, a compendious report on the *projet de loi*, by M. Hermery, and a great number of his colleagues, to relieve sugars employed in the *sucrage* and *vendange*.

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According to the latest official documents, published by the Belgian financial department, the quantities of beetroot sugar—*prise en charge* in the *fabriques* during the last season—have been 62,051,079 kilos., against 44,469,819 kilos.; and 79,796,003 kilos. in the two preceeding seasons. The quantities of sugar warehoused, or issuing from the *fabriques*, at the end of April, was 13,035,768 kilos., about double the quantity at the corresponding date of last year.

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The general meeting of the German sugar *fabricants* took place in Hanover, on the 24th and 25th May. About 600 persons were present, and about 300 took part at the banquet. Since the foundation of the association, this is the first time the meeting has been held in Hanover, as on account of the little encouragement held out by the preceeding Government, there were very few *fabricants* in the kingdom; but since 1866 the number of sugar-houses have considerably increased. The meeting of the chemists took place first, presided over, for the last time, by Dr. Scheibler, who has resigned his post as chemist to the association, and as editor of the *Zeitschrift*. He is succeeded, in both posts, by Dr. Stammer.

Among the most interesting questions studied was the determination of the sugar in beetroot. From communications by Dr. Scheibler, it seems the amount in beetroot juice, is not, as generally admitted, from 94 to 95 per cent., but varies between 88 and 92 per cent., giving a mean of 90 per cent.

The Central Committee of Sugar *Fabricants* met in Paris on the 13th June, when the following questions were discussed:— general customs tariff; interior sugar *régime*; commercial analyses of sugar; vinage, and sucrage; patents; sugar statistics, &c. Regarding the *projet de tarif*, the committee decided that the tax by degree ought not to be asked for, and that the division of the sugar into classes should be maintained. As regards the duty, it was unanimously resolved that every effort should be made to have it reduced.

The Swedish Government have just raised the duty on imported sugars. The duty is now 15 couronnes 27 oeres for sugar above the type number 18 D.S., and 11 couronnes 82 oeres for sugar below that standard. The old duty was 11 couronnes 60 oeres and 8 couronnes respectively. The couronne equals 100 oeres, and the oer equals 1 franc 50 cents.

The Russian official documents give, as the amount of sugar exported from that country, from 1st January to 1st April, 127,011 pouds, against 1,994,352 pouds in 1877. The Russian poud equals 16·38 kilog.

The following is the official statistics of the importation and exportation from Germany, for the nine months, September—May, in tons:—

	1877-8.	1876-7.
Beetroot worked .....	4,100,371	3,547,466
IMPORTATION.		
Refined .....	4,015	8,997
Raw .....	4,012	5,986
Syrup and Melasse .....	5,503	8,399

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EXPORTATION		
Refined .....	16,189 ....	10,027
Raw .....	67,011 ....	50,239
Syrup and Melasse .....	14,776 ....	13,568

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*L'Ecole pour l'Industrie Sucrière*, established in Brunswick, reopened its session on the 1st April. This remarkable institution is in its third year, and has at present 34 pupils, of whom 19 belong to Prussia, 11 to Brunswick, 1 to Russia, and 1 to Mexico. The ages of the pupils range from 10 to 30 years. The staff includes Dr. Schulz, director, the Drs. Frühling and Seyferth, well known by their works on the sugar industry, &c., besides different specialists, engineers, merchants, agriculturists, &c., so that every point is pushed in order to turn out thoroughly efficient men. The growing success of the school is the best sign that it meets the end its promoters had in view.

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### THE SUGAR BOUNTY SYSTEM.

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A special meeting of the Bristol Chamber of Commerce was held, June 21, to consider the question of foreign sugar bounties, from which Bristol has suffered so heavily. A resolution was proposed: "That immediate action should be taken by the Government to enable the sugar refiners of this country to compete fairly with those of other countries, and as the great bar to this is the foreign system of allowing a bounty on manufactured sugar exported to this country, a duty should, after the expiration of a certain definite notice, be levied on foreign manufactured sugar equivalent to the bounty allowed abroad." Arguing that this was a direct violation of free trade principles, Mr. Cashmore moved and Mr. Lane seconded, an amendment, deploring the folly of the foreign bounty system, declaring that the only hope of amendment lay in the enlightenment of opinion on the Continent on free trade principles, and recommending the Associated Chambers of Commerce to take measures to that effect. For the amendment only its proposer and seconder voted, and the motion was carried by a large majority; and copies were ordered to be forwarded to the Foreign and Colonial Offices and the Board of Trade.

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Mr. Gladstone having been written to on the subject of foreign sugar bounties, by the Bristol Committee of the Operative Sugar Refiners, from whom the Chancellor of the Exchequer had agreed to receive a deputation, replied as follows:—

Sir,—

I write a line under great pressure to acknowledge your communication. If, as I understand, the circumstances of the case continue unaltered, I think that both the trader and the workman engaged in the business of refining sugar have got reason to complain. My desire is that the British consumer should have sugar and every other commodity at the lowest price at which it can be produced without arbitrary favour to any of those engaged in the competition, but I cannot regard with favour any cheapness which is produced by means of the concealed subsidies of a foreign State to a particular industry, and with the effect of crippling and distressing the capitalists and workmen engaged in a lawful branch of the British trade.

I am, your faithful servant,

W. E. GLADSTONE.

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A conference of workmen engaged in the sugar refining trade was held at the Westminster Palace Hotel, on June 26, to take measures to put a stop to the unfair competition to which the trade in this country is exposed by the granting of bounties on the exportation of beetroot sugar by France, Germany, and other Continental countries. Delegates were present from Bristol, Plymouth, Manchester, Liverpool, and London. Mr. S. Morley, M.P., occupied the chair, and in opening the proceedings expressed his hearty sympathy with the object which the delegates had in view. The sugar refiners, he believed, did not wish for any departure from free trade principles; they asked for no protection, but they said that the French, and some other Continental nations, with a view to foster their own sugar trade, gave large sums as bounties on the exportation of their sugar, and the English manufacturers were thus subjected to an unnatural competition. He was glad to identify himself with this movement, the object of which was to

press on the Government the necessity of using their influence with foreign Governments to put an end to the bounty system, and in case of their failure he was prepared to go further and support the Government in imposing a countervailing duty on sugar imported under such circumstances.—Mr. Peters, the secretary of the association formed in Bristol, stated that he had received a communication from M. Léon Say, the French Minister of Finance, agreeing to receive a deputation on the subject, and he had also received a letter from Mr. Gladstone, in which he said he thought both the trader and the workman in the business of refined sugar have much reason to complain.—Mr. J. Hoggin moved a resolution declaring that in the opinion of the conference the time has arrived for the speedy abolition of the foreign sugar bounty system, as being unjust and immoral, and as causing untold misery and suffering to thousands of workmen in the United Kingdom. The resolution was seconded by Mr. Stevens, of Plymouth, and unanimously carried.—Mr. Peters remarked that there was no class of workmen in this country who had worked so hard and been so badly paid as those employed in the sugar refineries. While the wages of every other class of workmen had been raised, theirs had remained stationary for the last fourteen years, and their hours had increased to 80 a week. He moved “That in the opinion of this conference the British Government should make immediate representations to the French and other Continental nations which adopt the bounty system, urging them at once to discontinue the dishonest system of drawbacks, and to adopt the more just and equitable principle of refining in bond, which would meet with universal acceptance at the hands of the sugar operatives of the United Kingdom and the various other branches of labour dependent upon the British sugar trade. That should the British Government fail in their efforts to induce the various other Governments to compel the foreign refiners to refine in bond, it is the bounden duty of our Government to impose upon all bounty-fed sugars imported into the United Kingdom a temporary countervailing duty equivalent to the bonus received by the foreign refiners, such duty to remain in existence until the system of sugar bounties in any form is discontinued by the various

Powers where this protective system is in operation." In the course of the discussion on this motion, it was stated that the French Government paid £800,000 as bounty on the exportation of sugar from France in 1877, and the consequence of the system was that the sugar-refining trade in this country was being ruined, there being only two sugar refineries manufacturing loaf sugar now left, and the workmen who were thrown out of employment were left without any means of support. A duty of a farthing in the pound on the bounty-fed sugar would, it was said, be sufficient to put an end to the system; and in answer to an objection urged by one or two workmen in the employ of Mr. Duncan, a manufacturer of crystallised sugar near the Victoria Docks, it was pointed out by Mr. Andrew Dunn and others that the advantage in the price to the consumer under the present system is more apparent than real, inasmuch as the beetroot sugar is less sweet than West India sugar, and that when once the English sugar-refining trade was ruined the prices would probably be raised, and we should be at the mercy of the foreigner. Ultimately the resolution was unanimously passed, and the delegates present were appointed a committee to draw up a memorial to the Chancellor of the Exchequer and to the French Minister on the subject.

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THE PRINCE OF WALES.—We understand that the Prince of Wales has accepted an invitation to become President of the Royal Colonial Institute, and that the Duke of Manchester, in retiring from that office, has been appointed Vice-President and Chairman of Council.

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### Correspondence.

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TO THE EDITOR OF "THE SUGAR CANE."

Sir,—It is a fact, which must be known to all chemists engaged in sugar, that the total amount of sugar estimated in the polariscope, by direct and indirect readings, seldom agrees with the total obtained from a direct reading, and adding to this  $\frac{3}{4}\%$  of the percentage of glucose found.

There seems, however, some difference of opinion as to what

kind of sugar the discrepancy is of most frequent occurrence in, or whether, indeed, it occurs at all in cane sugar.

Under these circumstances, as I have had a considerable experience in the analyses of sugars of all kinds, I here give extracts (from complete analyses) to illustrate this one point under consideration. Incidentally, especially in the figures relating to canes, other information may be gleaned.

The polariscope, with which all the readings in the cane and East India sugars were made, is a Duboseq Soleil, which gives a reading of  $102.0^{\circ}$  for a solution of 16.35 gm. pure dry sugar in 100 c.c.,—the c.c. here being the space occupied by 1 gm. water in vacuo, and at a temperature of  $4^{\circ}$  c.

This error in the direct reading is strictly proportional;—a half normal solution polarizes  $51.0^{\circ}$ , and a quarter normal solution  $25.5^{\circ}$ , &c., &c. The erroneous direct reading, with the invert reading, gives the percentage of sugar correctly.

Throughout the direct readings the necessary correction has been made. All the flasks used have been re-gauged in the laboratory, and to the strict definition of the c.c. The glucose was estimated by Dehling's solution, strictly standardized.

It will be seen in the analyses of cane juice that (with the exception of the one uncultivated cane) where there is a difference between the total sugar theoretically, and total sugar shown on inversion,—in more than half the cases, the total sugar shown by the latter method is slightly more than the theoretical, and that only in 6 cases out of 14 is it slightly less; and in both cases the difference seems no more than due to the unavoidable errors of analysis.

In the one case, of the uncultivated cane, the total sugar is markedly less, as shown by inversion, than as shown by the theoretical process, and at the same time it may be noticed that the glucose is extraordinarily high.

From these facts, I should say, that, so far, my experience indicates that the discrepancy between total sugar estimated from direct and indirect readings, and the total sugar calculated by adding one-third of the percentage of glucose found, to the direct

readings, does not usually occur in cane (Ganjam) juice, though it may exceptionally.

CANE JUICE (GANJAM CANE.)

	Glucose, %	Direct Polariza- tion, %	Hence Total Sug. Theoreti- cally.	Total Sugar shown on Inversion.
Cane, unripe—Nov. '76 ..	4.14	8.04	9.42	9.2
Ditto ditto ..	2.34	12.56	13.34	13.6
Ditto ditto ..	4.03	8.72	10.06	10.2
Ditto Nov. '77 ..	3.5	7.64	8.8	8.6
Ditto ditto ..	2.5	11.00	11.84	11.6
Cane, ripe—Mar. '78,				
Top of Cane	1.42	14.4	14.87	15.0
Middle „	1.8	14.4	15.0	15.0
Root „	1.4	15.4	15.86	15.88
Cane very nearly ripe 3/78,				
Top of Cane	2.86	10.8	11.68	11.5
Middle „	1.65	13.9	14.45	14.55
Root „	1.68	13.8	14.36	14.58
A sample of picked cane, ripe, Mar. '78, Top of Cane	2.63	9.6	10.48	10.27
Middle „	.806	14.5	14.77	14.93
Root „	.775	14.8	15.06	15.11
A cane altered by drought. .	5.68	9.5	11.04	11.38
A cane introduced into the district from Bengal— not now cultivated— a single rattan growing among Gangam cane— uninjured .....	7.1	7.55	9.92	9.08

On the other hand, it will be seen from the table of cane juice in its stages of manufacture, that no sooner has the juice been “cooked,” than the discrepancy begins to develop itself, and pretty much in proportion to the extent of the cooking. As a rule,

too, the discrepancy is larger where there is more glucose, but not proportionately so.

### CANE JUICE IN ITS STAGES OF MANUFACTURE.

	Glucose %	Direct Polariza- tion, %	Hence Total Sug. Theoreti- cally.	Total Sugar shown by Inversion.
Diffusion juice from clarifier	2·61	8·7	9·6	9·6
Ditto, after lime and bag- filters .....	1·53	9·2	9·7	9·5
Ditto ditto	1·55	10·8	11·32	11·0
Same, sample, after pas- sing over char, over which thick liquor had been passed .....	1·44	11·56	12·04	11·7
This, after concentration ..	5·66	38·2	40·1	39·5
„ charcoaling ....	3·15	32·34	33·4	33·5
Another sample, after con- centration and charcoaling	5·77	32·8	34·8	33·5
Another, after concentration	9·00	36·75	39·75	38·8
Char wash, water, off-juice, 9·6° Ball .....	1·07	6·0	6·3	6·7
1st Boiling Masseccuite, char used about 30 % on cane	11·75	81·3	85·2	80·0
1st Boil. Masseccuite, no char	12·74	73·5	77·75	76·0
Uncured Sugar fm. centrif.	2·65	94·5	95·4	95·5
1st Syrup, no char (diluted)	10·5	16·2	19·7	19·5
Ditto with char ....	20·38	45·0	51·8	48·2
Ditto no char .....	17·4	42·1	48·0	46·0
Ditto with char ....	15·26	40·6	45·7	44·2
Ditto ditto .....	20·38	41·6	48·4	45·4
Ditto ditto .....	15·26	44·1	49·2	47·4

Ganjam jaggery, I may say, is prepared by the natives by simply concentrating this cane juice, with or without lime, in earthen pots, over an open fire, to graining point, and then leaving to crystallise. The jaggery is put into the market in the pot, and

contains all its syrups, and may therefore be considered as simply cane juice concentrated.

The discrepancy is, by far, larger in the Ganjam cane sugar than in either the Cocanda, Palmyra, or Bengal date.

## RAW SUGARS.

	Glucose %	Direct Polariza- tion, %	Hence Total Sug- Theoreti- cally.	Total Sugar shown by Inversion.
Gangam jaggery, limed ..	15.6	64.7	70.0	65.0
Ditto without lime	27.8	54.3	63.6	60.0
Cocanada Palmyra .....	1.98	78.4	79.1	78.0
Ditto .....	3.3	82.3	83.4	80.0
Bengal date .....	19.11	57.8	64.2	62.0
Ditto .....	5.88	69.6	71.6	70.6
Ditto .....	3.21	74.5	75.6	75.4
Ditto .....	6.95	65.7	68.0	66.0
Ditto .....	21.3	45.1	52.2	50.8
Pernambuco .....	4.43	89.0	90.47	90.0
Hogshead West Indian ..	3.6	89.5	90.7	89.5
Havannah .....	3.45	94.0	95.16	94.25
Concrete, fine .....	1.53	93.0	93.61	93.5
Ditto 2nds .....	2.44	83.5	89.3	88.5
Ditto 3rds .....	3.77	82.5	83.76	82.7
Cuba .....	3.64	87.5	88.72	88.2
Crystallised St. Vincent ..	6.12	86.5	88.6	87.3
Egyptian Syrups .....	3.6	90.5	91.7	90.5
Bahia .....	6.5	83.5	85.7	85.0
Molasses from Demerara ..	33.2	31.0	42.2	38.2

The polarization of the West India sugars, and of the Refiners' Produce, were made with another instrument, also a Duboscq's Soleil, which was nearly accurate, I know, but the exact amount

of the error of which I forget, and have no notes by me to refer to. The error, however, was not sufficient to account for a discrepancy of 0.5 %.

## REFINER'S PRODUCE.

	Glucose %	Direct Polariza- tion, %	Hence Total Sug. Theoreti- cally.	Total Sugar shown by Inversion.
Piece .....	2.73	94.75	95.7	94.25
„ .....	2.55	92.00	92.85	92.0
„ .....	4.7	88.4	90.0	88.0
„ .....	4.7	89.0	90.6	89.0
„ .....	5.86	86.5	88.46	86.5
„ .....	8.5	85.0	87.8	85.0
„ .....	8.74	84.75	87.67	84.25
„ .....	9.83	82.75	86.0	83.0
„ .....	8.26	85.5	88.3	85.0
Jelly Syrup .....	21.8	38.5	45.8	39.2
Bastards .....	8.26	82.0	84.8	82.0
„ .....	6.95	82.5	84.8	81.75
Piece Syrup .....	12.48	47.7	51.87	48.0
„ „ .....	12.7	48.5	52.7	49.0
Refinery wash-waters, hhd. steamings, scum liquor, bag wash'gs, &c. }	10.5	38.0	41.5	38.0

I can offer no explanation of the discrepancy ; it may be owing to the presence of an optically inactive sugar, or to a disproportionate destruction of the lævulose as compared with the dextrose of the glucose, and in short to anything which would destroy the relation between the dextro-rotatory power of saccharose, and the lævo-rotatory power of the invert sugar (glucose) derived from it.

Your obedient servant,

FRANCIS N. G. GILL.

*Aska Sugar Works and Distillery, Ganjam.*



The New Zealand Government has advised Sir Julius Vogel, the Agent-General in London, that it is prepared to give a bonus of £5,000 for the first 500 tons of beetroot sugar produced in the North Island, and a similar bonus for the same quantity produced in Middle Island.

A SUGAR-CANE DISEASE IN PORTO RICO, produced by a certain worm, has spread so rapidly that a Royal order has been issued for an investigation into its cause and character and the means of prevention. The disease, thus far, appears to be confined to Porto Rico.

"The Manilla Yengarie Sugar Company" have been authorised by the Government to lay metallic pipes to carry cane juice from several villages in the Province of Batangus to the coast. The *Comercio* says that another sugar-house, long established, at Manilla, will soon commence to refine by a recently invented process, in use in the Oriental Refinery in Hong-Kong, and in another establishment at Penang.

### MONTHLY LIST OF PATENTS.

Communicated by GEORGE DAVIES, C.E., Patent Agent, 4, St. Ann's Square, Manchester.

#### ENGLISH.

##### APPLICATIONS.

2043. WILLIAM FREAKLEY, of Longton, Stafford, engineer. *Improvements in filter-presses.*

2211. HUNTER HENRY MURDOCH, of 7, Staple Inn, Middlesex. *Improvements in the refining of sugar.* (A communication from Emile Barrault, of Paris.)

2280. CHARLES DENTON ABEL, of 20, Southampton Buildings, Chancery Lane, Middlesex. *Improvements in sugar cane mills.* (A communication from T. Rousselot, of Martinique, West Indies.)

2321. ALEXANDRE SÉZILLE, of Levallois Perret, Seine, France. *An improved method of treating raw maize for use in the manufacture of sugar, glucose, fecula, alcohol, and beer, the basis of the process being the chemical decortication of the germs of the maize before using this grain in these various industries.*

##### ABRIDGEMENTS.

400877. WILLIAM JASPER & STEPHEN BOUSHEY, of San Francisco, California, machinists. *Improvements in machines for cutting and pressing*

*sugar into cubes.* This invention comprises an arrangement of knives or cutters in a rectangular form with a series of presses in each rectangular space. When the cutters are pressed down into a mass of sugar in the mould, the sugar will be divided and pressed into a number of solid compact cubes by the combined action of the reciprocating cutters and the operation of the pressers. A set or gang of cutters is arranged upon a plate or frame, to which a proper movement is given by means of a lever connected with a reciprocating plate by a link. These cutters are formed of thin metal blades, or plates intersecting and crossing each other at right angles. Within each space thus formed is placed a rectangular block or presser, which has no movement. Each of these presses is held by means of a rod and nut, and by means of this arrangement, the said pressers can be adjusted with reference to the bottom of the bed plate. The cutter plate is connected with the reciprocating plate by the said rods, made adjustable in a vertical direction by nuts, and the cutters have a reciprocating motion out from the machine and back again, between the stationary pressers for a distance equal to the depth of the mould. (The above invention received Provisional Protection only.)

4021. HENRY CONRADI, of 8, Lower James Street, Golden Square, Middlesex. *Improvements in the manufacture of sugar from beetroot and apparatus used therefor.* (A communication from Herrmann Prieu, of Bernburg, Anhalt, Germany.) This new method avoids all the disadvantages of the former methods of centrifugal force, and steam, or water, such as the unfinished and impure product obtained by an insufficient quantity of steam or water, and the waste caused by the excessive condensation of steam dissolving the crystals. The apparatus consists of a steam cap or receptacle, into which the steam enters through a pipe, passing through a perforated plate which retains the condensed particles. The receptacle is protected by non-conductors of heat. Into the bottom of this receptacle is introduced a sort of funnel which has its opening or mouth-piece above the perforated plate. This funnel is lined with felt, and at its closed extremity is placed a sponge, and it has a longitudinal opening on one side. The felt and sponge suck in any further condensation of the steam, as the latter passes through the funnel. The cap and funnel are fixed on to the movable part of the cover of the centrifugal apparatus in such a manner that the funnel is entirely within the latter, and the longitudinal opening faces the circumference of the centrifugal apparatus; the dry steam thus passes over the contents thereof. The injector of the concentrated solution of sugar is also fixed on the cover of the centrifugal apparatus, but on the opposite side thereof. One side of this injector is perforated, and distributes the solution, under one atmosphere of pressure, over the whole material in the apparatus. Thus the two-fold influence of the steam and the centrifugal force is obtained.

## BELGIAN.

- 44726 H. MEYER. *Manufacturing sugar.*  
44831. L. J. LINARD. *Applying a special tissue for extracting beet juice and other liquids by continuous presses.*  
44875. H. PRIEW. *Producing white sugar.*  
44895. J. H. WHITE. *A continuous apparatus for evaporating cane juice.*  
44908. P. OLIVIER-LECOQ, of Tournai. *A plough for extracting beetroots.*  
44922. E. LANGEN. *Manufacturing tablets of refined sugar.*  
44964. E. ROETTGER. *A double action, or sterhydraulic filter-press.*  
44967. A. ZENISEK & C. SCHMIDT. *Extracting sugar from its residues and from cane trash.*  
44983. J. C. R. OKES and H. ROBINSON. *Improvements in filter-presses.*  
45101. W. NEEDHAM, J. & J. KITE. *Improvements in apparatus, filters, or presses for filtering liquids, &c.*

## ITALIAN.

70. J. BOWING, of London. *Improvements in filter-presses.*  
110. G. LOEWIG, of Dresden, and F. LOEWIG, of Goldschmieden. *Clarifying sugar.*

## AMERICAN.

193589. WILLIAM J. ALLEN, of Buffalo, New York. *Improvements in condensers for engines.* It is the object of this invention to so improve the construction of condensers for engines and vacuum pans, that a more perfect vacuum shall be produced than is attainable by siphon and other condensers now in common use, upon which the present invention is an improvement. The invention consists primarily in providing the condenser-head with an air-pipe, extending to a proper height within the same, with which air-pipe a water-pipe, communicating with the interior of the condenser-head is so combined that the water it conveys shall be discharged into the air-pipe, at a point below its induction orifice, whereby the air in the condenser-head is caused to flow through the said air-pipe, and an improved vacuum is obtained. The invention also includes the arrangement of a plurality of such air and water-pipes, and combinations of them with other parts of the apparatus. What is claimed is—Firstly, the combination with a condenser-head of an air-pipe and a water-pipe, the said air and water-pipes being so arranged that the latter will discharge into the former below its induction orifice. Secondly, the combination with the condenser-head of a plurality of water-pipes and air-pipes, which pipes are arranged in pairs, so that a water-pipe discharges into an air-pipe, and the said water-pipes have their induction orifices arranged at different heights.

202,016. JAMES W. GAFF, of Cincinnati, Ohio. *Improvement in processes of reducing vegetable substances to prepare the same for saccharification.* The object of this invention is to modify the ordinary steaming process that the

mass to be reduced shall be kept throughout the process in active ebullition and agitation by the steam, to provide for the thorough diffusion of the latter so that all the particles may be equally effected thereby, and a uniform temperature maintained throughout the whole mass. To this end the invention consists in subjecting such vegetable substances to a current or currents of steam under pressure, so that the agitating action of the flowing steam, by aiding its thorough diffusion, will bring its solvent properties to bear alike upon all parts of the mass, and also have a certain mechanical effect thereon to hasten the reduction and make it more perfect. The process may be practised by means of a tight vessel which has an escape-valve at the top for the constant or intermittent escape of steam, or is connected or provided with means for constantly condensing a small quantity of steam at the top of the mass, the result in either case being the maintenance of a current of steam through the mass, and the consequent active ebullition and agitation of the same.

202,135. BENJAMIN T. BABBITT, of New York. *Improvements in centrifugal machines.* The essential improvements consist in,—first the combined arrangement of parts by which water or air is passed into the machine through the central shaft from the bottom; second, releasing and voiding the solid contents by a capacious sluice extending from the centre of the bottom, and extending beyond the side of the machine; third, providing ports in the bottom of one cylinder and sliding valves attached to the bottom of another cylinder, through which means, aided by a scraper, the contents fall into the sluice or are shut off and retained. The improvements also consist of an apparatus for cleansing grain and other materials, heating such materials in a rotating perforated cylindrical curb or curbs with hot or cold water, water solutions of salts, acids, or other properties, with cold or hot air or gases, with steam or other vapours, in every case according to the substance to be acted on and the desired result from the treatment.

202,251. GEORGE F. EISENHARDT, of Philadelphia, assignor to himself, Herman Dienelt, and Geo. F. Gelbach of same place. *Improvements in centrifugal machines.* This invention relates to an improvement in that class of hydro-extractors in which the vertical shaft is driven by a steam engine secured to the machine; and the object is to so combine a steam engine with the machine that the heaviest parts of the former shall be within the limits of the latter, and much nearer to the vertical shaft than usual, thereby obviating the jarring which has hitherto been an objectionable feature in machinery of this class. The invention consists in the combination in a hydro-extractor, of a bridge, and a vertical shaft, with a steam engine arranged on the said bridge within the limits of the base of the casing, the crank on the said shaft being situated between the steam-engine cylinder and the pin by which the connecting-rod is jointed to the piston-rod.

202295. FRANCIS L. STEWART, of Murrys ville, Pennsylvania. *Improvement in compounds for defecating saccharine liquids.* This invention relates to that class of compounds used to clarify saccharine liquids in the process of their manufacture into sugars and syrups; and it consists in a composition formed by mixing a solution of tannic acid with liquid sulphurous acid, and saturating the mixed acid solution so formed with hydrate of alumina, forming tanno-sulphite of alumina.

## SPANISH.

37. J. MICHEL, of Marseilles. *A machine for moulding raw or refined sugar.*

66. L. J. REY, of Geneva. *A process and apparatus for evaporating sugar.*

86. F. A. BONNEFIN. *Improvements in extracting the juice of sugar cane and other vegetable substances.*

105. J. BOWING. *Improvements in filter-presses.*

128. C. SILTER, of Paris. *Producing artificial animal black.*

## SWEDISH.

159. G. L. and F. LOEWIG. *Clarifying sugar-juice.*

167. J. BOWNING. *A filter-press.*

## AUSTRIAN.

80. E. PECHNIK, of Steinitz. *A stirring apparatus for accelerating and perfecting the diffusion process in sugar works.*

98. J. SELWIG and N. MEHRLE, of Brunswick. *A compound distribution-valve for diffusion apparatus in sugar works and lixiviators in general.*

## GERMAN.

1346. S. H. JOHNSON, of London. *A process and apparatus for obtaining grape sugar of corn.*

1347. PFEIFFER and LANGEN, of Cologne. *An osmose apparatus.*

BENJAMIN KISH COHEN DE LISSA. *Improvements in the manufacture of sugar.*

JOHN BOWING. *Improvements in filter-presses.*

## SUGAR STATISTICS—GREAT BRITAIN.

TO JUNE 15TH, 1878 AND 1877. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

	STOCKS.		IMPORTS.		DELIVERIES.	
	1878.	1877.	1878.	1877.	1878.	1877.
London . . . .	72	78	117	138	141	111
Liverpool ..	43	39	101	110	88	88
Bristol . . . .	4	4	21	22	20	20
Clyde . . . . .	66	46	138	133	111	105
Total ..	185	167	377	403	360	324
	Increase.. 18		Decrease.. 26		Increase.. 36	

STOCKS OF SUGAR IN THE CHIEF MARKETS OF THE WORLD ON THE  
1ST MAY, FOR THREE YEARS, IN THOUSANDS OF  
TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
162	117	40	36	3	358	312	410

CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING  
1ST MAY, IN THOUSANDS OF TONS.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
898	277	23	290	182	1670	1561	1659

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE,  
FOR THE ENSUING SEASON, COMPARED WITH THAT OF THE THREE  
PREVIOUS SEASONS.

(From *Licht's Monthly Circular.*)

	1877-78.	1876-77.	1875-76.	1874-75.
	Tons.	Tons.	Tons.	Tons.
France .....	385,000 ..	243,295 ..	462,259 ..	450,877
Germany (Zollverein) ..	370,000 ..	291,204 ..	346,646 ..	250,708
Austro-Hungary ....	250,000 ..	205,267 ..	180,138 ..	140,192
Russia and Poland ..	220,000 ..	250,000 ..	245,000 ..	222,500
Belgium .....	65,000 ..	44,467 ..	79,796 ..	71,079
Holland and other Countries.....	25,000 ..	25,000 ..	30,000 ..	30,000
Total.....	1,315,000	1,059,233	1,343,839	1,165,356

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STATE AND PROSPECTS OF THE SUGAR MARKET.

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The sugar market has been healthy and steady during the past month, and prices of raw sugar have advanced from 6d. to 9d. per cwt., whilst refiners have secured a larger advance on their products, and one which was very much needed by them.

The excess of stocks, as compared with 1877, is further reduced, standing on the 22nd June at 19,288 tons, against about 21,000 on the 18th May as compared with those dates in 1877.

The deliveries have been, during the past month, about on a par with those of June, 1877; and for the year are about 35,500 tons more than in 1877 at this time.

The market closes firm, with a tendency upward; and we think a further advance is more probable than a decline in value during the ensuing month or two, though we do not at present anticipate more than a steady market.

Present quotations of the standard qualities are as under:—  
Porto-Rico fair to good refining, 21s. to 22s., against 20s. 6d. to 21s.; good to fine grocery, 23s. 6d. to 25s. 6d., against 23s. to 25s.; Martinique crystals, 27s. to 27. 6d., against 27s. to 27s. 6d.; No. 12 Havana, 23s. to 23s. 6d., against 22s. 6d. to 23s.; fair to good refining Cuba Muscovados, 21s. to 21s. 6d., against 20s. 6d. to 21s.; middling to good brown Bahia, 19s. to 19s. 6d., against 18s. 6d. to 19s.; good to fine Pernambuco, 19s. 6d. to 20s. 6d., against 19s. to 20s.; Paris loaves, 28s. 3d. to 29s. against 27s. 6d. to 28s. 6d.

# THE SUGAR CANE.


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No. 109.

AUGUST 1, 1878.

VOL. X.

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 The writers alone are responsible for their statements.

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## THE WORKING MAN AND THE SUGAR BOUNTY.

In our last number we gave a report of the Conference of working men engaged in the sugar refining trade, held at the Westminster Palace Hotel, on June 26th. At this meeting the various sugar refining centres were well represented. Mr. Samuel Morley, M.P., presided, and distinctly stated that he was prepared to support the Government in imposing a countervailing duty on sugar receiving a bounty on exportation. A letter from Mr. Gladstone was read, in which he stated that "he could not regard with favour any cheapness which is produced by means of the concealed subsidies of a foreign State to a particular industry, and with the effect of crippling and distressing the capitalists and workmen engaged in a lawful branch of British trade." At this meeting resolutions were passed condemning the bounty system; declaring that the Government should continue to urge the French and other continental nations to discontinue it by adopting the principle of refining in bond; and that, in the event of failure, a countervailing duty should be levied on all bounty-fed sugars. Finally, delegates were appointed to wait upon the Chancellor of the Exchequer and the French Minister of Finance.

This movement, which has been set on foot quite spontaneously by the sugar operatives, is evidently gaining ground. We give, in another part of our impression, reports of the deputation to the Chancellor of the Exchequer, the interview with M. Say, the French Finance Minister; a meeting of the Coopers of the City of London, and a large public meeting held in the East End of London.



In addition to these important demonstrations, the working men have had interviews with M. Gambetta, in Paris, and with Count Bylandt, the Dutch Minister in London. The leader of the French Republican party in France sympathised entirely with their views, and said he would do all in his power to secure an abolition of the bounty. On the return of the deputation from Paris, a meeting of the Committee,—now styled the Executive Committee of the Sugar Operatives, Coopers, Warehousemen, and Dock Labourers' Society,—was held, at which progress was reported. It was stated that committees had been formed in Glasgow, Edinburgh, Greenock, Liverpool, Bristol, Manchester, Plymouth, and Dublin; and it was resolved that the members of the trade should not abandon the present agitation until a temporary counter-vailing duty was imposed upon all subsidised sugar imported into this country. It was also resolved to make the question of the abolition of the sugar bounties a test question for candidates at the General Election.

The importance of this movement of the working men has led us to give a very large portion of our space to reports of meetings and articles in reference to them, and we must therefore postpone much valuable matter till our next issue. We do not hesitate to do so because we know how vital is the question to all connected with sugar production, and therefore how necessary it is to give full reports of, and a circulation to every phase in, this great struggle against subsidised foreign competition, a struggle which now promises to end in success.

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### THE CHANCELLOR OF THE EXCHEQUER ON THE SUGAR BOUNTIES QUESTION.

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A deputation of working men employed in the sugar-refining trade waited on Sir Stafford Northcote, the Chancellor of the Exchequer, at the Treasury on the 27th June, to lay before him the injurious effect on their trade by the granting of bounties by foreign Governments on the exportation of sugar. The deputation comprised working men from Bristol, Plymouth, London, and other

places, and it was stated that letters had been received from the workmen of Glasgow, Leeds, and Dublin, saying that the men there agreed in the objects of the deputation, but could not afford the expense of coming up to London. The deputation was accompanied by Mr. S. Morley, M.P., Mr. Sampson Loyd, M.P., Mr. Ritchie, M.P., Mr. Macdonald, M.P., and Mr. Andrew Dunn.

Mr. S. MORLEY, M.P., said he had been asked to introduce the deputation in consequence of his representing Bristol, where a great amount of suffering had been caused by the system of which they complained. The deputation was formed of a very respectable class of men, and they complained of what had been described as an unusual, and he could almost add scandalous, departure from the principles of free trade—the system of bounties by foreign Governments on sugar. If no other mode could be adopted to remedy this injustice, it had been suggested that a countervailing duty should be imposed; and this he thought might be done even in the interest of the consumer, rather than suffer the entire destruction of the refining trade, which would place us at the mercy of foreigners with regard to sugar.

The Secretary to the Workmen's Association then read a memorial setting forth the views of the workmen, and recommending a countervailing duty of a farthing per lb.

Mr. Peters, of Bristol, Mr. Stevens, of Plymouth, Mr. Dean, of London, and Mr. Donald, of Manchester, spoke in support of the memorial, and Mr. Sampson Loyd, M.P., Mr. Ritchie, M.P., and Mr. Macdonald, M.P., followed with the expression of a hope that something should be done to remedy the evil complained of.

The CHANCELLOR OF THE EXCHEQUER said he could assure them that this was a question which had given the Government a great deal of anxiety, and they did not at all wonder at the representations which had been made that day, following up other representations which had from time to time been made. He knew it had been said—sometimes he had seen it put strongly in the journals—that if foreign countries chose to pay bounties, or anything in the nature of bounties, on the sugar which they exported, and thereby supplied us with an article cheaper than it would

otherwise be, we, as a nation, had nothing to do but to take advantage of their folly, and that we need not trouble ourselves as to the effect it had on this or that particular trade. He wished to say that he entirely dissented from that view. (Hear.) He did not think that we ought to comfort ourselves with arguments such as those. In general he agreed in principle with what had been said by so many there present. He agreed with what had been so well said by Mr. Sampson Lloyd, that we ought not, by any legislative enactment, to interfere to prevent other countries making use of their natural advantages to supply us with the products which they could supply more advantageously than we could. But that principle did not apply to a case in which, by legislative action on the part of a foreign Government, by any artificial action on their part, they could supply us with an article which, if things were left to their natural courses, we could supply as cheaply or more cheaply ourselves. But there was more in this case than appeared on the surface. In the statements made that day he thought they had treated it a little too much as if it were simply one nation, or more than one nation, giving a direct bounty on the article of sugar. Mr. Lloyd had put an imaginary case of bounties given on cotton or iron goods, and he had asked whether, if that were done, it would not be met by a countervailing duty on the part of this country. It was very easy to say that a bounty was given by a foreign country, but they must remember how the matter arose. Duties were imposed in all those countries on refined sugars. The raw sugar was refined, and it was to be exported, and the refiners went to their Governments and said, "We have refined this sugar, and are going to export it; will you repay us the amount of duty we have paid?" "Well," the Government said, "of course we will do so." And that was quite right. But the way in which the tax was ascertained was a complicated matter. In France, and perhaps in some other countries, there were cases, and perhaps a good many cases, in which certain manufacturers contrived to get more in the shape of return for duties than they had paid, and then it became a bounty. But all that was a difficult thing to ascertain; they could not measure it.

It was not as if the French Government, or any other Government, said, "We give a bounty of 5s. per cwt. on the sugar refined and exported." If they did that, it would be simple enough to say, "We will put on a corresponding duty here." They did not treat it in that way; but they made their calculations, and these calculations admitted, in certain cases, of fraud. Then, how were we to deal with the matter? Was our dealing with it to be applicable to all countries alike? Was the duty we were to impose to be equal on sugars from France, Belgium, Holland, and so forth? And was the amount to be the same on different classes of sugars? It would be very difficult indeed to set up the exact method of meeting the evil of which the deputation complained by a countervailing duty; and then it would be very difficult to prevent the duty being evaded by sending the sugar from one country to another. Let them look for a moment to see what was the real condition of things—how far the sugar trade of this country, the refining trade, was affected by these bounties. It was quite possible that there were other causes at work. For instance, they were told by one of the delegates that he came from Plymouth twenty-three years ago because the trade there was not good; but it was good in other parts of the country. He was struck with this—the last few years had been very bad years for the trade of this country generally. It could not be denied that the exports of this country had in all branches suffered very considerably. The exports generally, from 1872 to 1877, fell off from 255 millions to 198 millions, but in the exports of sugar there had been no falling-off, but a considerable increase, the exports of refined sugar in 1873 being a little over a million, and in 1877 £1,545,000, or an increase of about 47 per cent. He knew he should be told that that did not apply to the particular kind of sugar in which they were probably most interested—namely, loaf sugar—but only to other classes of refined sugar. Yet they had the remarkable fact, that during a period which had been one of general distress, in which there had been a great falling-off in the exports generally, in the case of sugar there had been an increase. Of course they could not shut their eyes to the fact that in France, and some other

countries on the Continent, they had large quantities of the best raw material for refining grown in the country—the beet-root sugar; and that gave them some natural advantages, and placed the sugar refiners of this country at a disadvantage. But, admitting that the difficulties in regard to the bounties do exist, how were they to meet them? They said, by a countervailing duty; but he had shown the great difficulty attending that. Then they proposed that the sugar should be refined in bond, and he agreed with those who said that the only remedy was to induce foreign countries to accept the system of refining in bond. Then there would be no question of either paying duty or getting a drawback. But the deputation must bear in mind that this was a question that affected this country as well as others, and that before the sugar duties were repealed in this country the manufacturers objected to refine in bond because of the disadvantages that it subjected them to; and other countries would say, “It is all very well for you in England to talk of refining in bond, but you objected to it when you had a duty, and so do we.” He was showing them the difficulties in the way of settling this question. The Government, however, were convinced that the present system was an erroneous one, and they were earnest in their wish to put an end to it, and they were at that moment in communication with other Powers in order to put what pressure they could on the Powers which acted on this system, with a view to induce them to alter their decision with regard to refining in bond. The right hon. gentleman added that he could not help thinking that a great deal might be done by negotiation. He would also say that for some time there were negotiations between this country and France with reference to a renewal of the commercial treaty. At that time the question of sugar was not included in the subjects which were to be negotiated upon. It was treated apart. He thought we ought to introduce the question of sugar in any further negotiations to improve the relations existing between this country and France generally. He had told them quite frankly what he felt on the subject. He did not at all wonder at the spirit that animated those who were interested in

the trade. He thought it very natural that they should feel strongly that something should be done for them, and he was bound to say that the representations which had been made were much to the credit of those who made them.

Mr. S. MORLEY, M.P., in the name of the deputation, thanked the right hon. gentleman for the courtesy with which he had received them, and the statement he had made, and the deputation then retired.

After leaving the office of the Chancellor of the Exchequer, the National Deputation of Sugar Operatives adjourned to the Westminster Palace Hotel, and again resolved themselves into a conference. Mr. C. Fox was voted to the chair, and said that their special business at that conference was to appoint the delegates who should meet M. Leon Say, the French Minister of Finance, in Paris on the 2nd of July. That, he said, was a very important matter. Referring to the reply given by the Chancellor of the Exchequer to the deputation which had just waited on him, the chairman said he thought a great point had been gained by the admission made by Sir Stafford Northcote to the effect that they were right in the work they had undertaken. Fortified by that admission, in addition to the simple justice of the cause they had at heart, it was the duty of the working men engaged in the sugar industries of all branches not to cease their efforts until the bounty system was abolished. The conference then appointed the delegates who are to wait on the French Minister of Finance.—Mr. Peters moved, and Mr. R. Hunt seconded, the following resolution:—"That the best thanks of the conference be accorded to the Right Hon. Sir Stafford Northcote, Chancellor of the Exchequer, for the urbanity and courtesy displayed by him to the deputation, as well as for the hopes he held out for the amelioration of the sugar trade." This was unanimously carried. A special vote of thanks to Mr. Samuel Morley, M.P., "for his disinterested efforts on behalf of the suffering workmen," and votes of thanks to the various members of Parliament and other gentlemen who accompanied the deputation, having been adopted, the conference broke up.

## THE DEPUTATION OF WORKING MEN TO M. LÉON SAY.

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Several and various reports have appeared in the daily papers of the reply given by M. Léon Say, the French Minister of Finance, to the English sugar operatives who went to Paris—entirely of their own accord—to interview him on the subject of the bounty given in France on the exportation of refined sugar. These reports were all evidently more or less defective; it was, therefore, satisfactory to find, in a weekly paper, an authorized version furnished by the London agents for the sale of Say's loaves.

It is as follows:—

“On Tuesday last, July 2nd, the French Minister of Finance, M. Léon Say, received a deputation of English operative sugar refiners. These delegates complain that the competition which exists between the English and French refiners is not loyal, on account of the bounties which are accorded to the French establishments, bounties which they say amount to 20,000,000 fr. (£800,000) a year. Having taken note of the address which the English operatives had presented to him, the Minister of Finance replied that he was in principle very much opposed to the system of bounties, but at the same time he thought that the French sugar laws were imperfectly understood by English people, even those connected with that trade. What the English refiners call bounties, the Minister said, originates from the belief that a certain amount of sugar is left in the hands of the refiners free from duty, which sugar they can deliver for internal consumption at current prices for duty-paid sugar. This quantity of sugar which remains in the hands of the refiners is an excess of produce over the legal standard, which can only be obtained by refining certain well known qualities of raw sugar, for which qualities of sugar the manufacturers claim a correspondingly high price, and so a certain portion (the largest) of that which the English operatives call a bounty is acquired by the manufacturers of home-grown sugar, or by the importers of colonial sugar of the same nature. From another point of view, the refiners, who buy these

raw sugars for home consumption, being placed in free competition with many other refiners, are obliged to abandon to the public a second portion of this surplus; and thus another part of that which the English operatives call a bounty is, in reality, only a reduction of interior taxation. One perceives, then, that this system of bounty, so far as it may exist, does not act entirely on the foreign markets. It would, however, be a very grave inconvenience to the French Treasury, as well as to the equality desired to be established between the competing industries, if the sum of 20,000,000 fr. spoken of by the English operatives had in reality any existence. But it has none, and it has been proved by repeated experience, made with the greatest care throughout last year in the laboratories of the State, that the excess of produce in the refining process cannot exceed 3,200,000 kilogrammes (7,040,000 lbs.) of refined sugar, representing, at 73fr. 32c. per kilogramme, a duty of 2,350,000 fr. (£94,000). These simple figures prove that the question is not of any great importance to the English market; but it is of importance to the French Treasury, and the authorities are occupying themselves with the means to remove this difference.

“Two remedies have been proposed:—1. By putting the refineries in bond, under the inspection of the officers of indirect taxes. 2. By the imposition of a tax regulated by the amount of saccharine matter in raw sugar determined by scientific process, viz., the saccharimetric system.

“The control of the refiners in bond imposes considerable inconvenience and expense on the manufacturers, and would compel the Administration, without doubt, to apply the system which the English Government has applied to alcoholic distillers. In order to indemnify English distillers who export for the charge of control, they are allowed 7fr. 90c. (6s. 5d.) per hectolitre (twenty-two gallons), which thus constitutes a sort of bounty; if then we adopt the first proposal of refining in bond, we shall be obliged to follow this same course. But control has, in addition to others, the great inconvenience that for the collection of very large sums the Government has to depend upon the exactitude of the men



who have charge of the inspection, for if the inspection of these officers was not continually perfect, a loss of from 10 to 15 per cent. would very quickly result.

“ The saccharimetric system may be considered by many persons as not altogether perfect, but we have every reason to believe that the loss in the collection will not be greater than that which we submit to in the collection of our other duties. Thus, whatever may be the conclusions arrived at from an international point of view, we are preparing for the autumn a law founded on the saccharimetric system. It is well to remark that the international difficulties of which we have been speaking are not the only ones which exist. If one wishes to establish a loyal competition between English and French refiners, it must amongst other things extend above all to the abolition of the bounties on raw sugar everywhere, as if, that did not take place, the French refiners, who cannot buy this raw sugar which receives a bounty without paying customs duty, which is not recoverable, will not be on the same footing as the English refiners in the English market, as long as the latter can receive at low prices Austrian sugar, for example, which enjoys a considerable bounty.”

*(See also page 412.)*

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## MEETING OF THE COOPERS OF LONDON ON THE SUGAR BOUNTY.

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A meeting was held on the 11th July, in the Coopers' Hall, Commercial Road, Whitechapel, to consider the question of sugar bounties, when the following resolutions were carried, condemning such bounties, and setting forth an opinion that it would be quite consistent with every principle of free trade to restore free trade competition to the English operative by levying against all raw and refined sugar exported under a bounty a duty equivalent to the bounties. It was determined to send copies of these resolutions to Mr. Gladstone, M. Léon Say (French Minister of Finance), and the Ministers of other countries in which sugar bounties are given.

1ST RESOLUTION.

"That in the opinion of this meeting, composed of the Coopers of London, the doctrines of free trade require that all competition should proceed upon the basis of relative natural advantages, thereby securing to consumers the lowest natural price approximating to the lowest natural cost of production; and that the bounties given or obtained on exports of raw or refined sugar to this country, from France, Holland, Belgium, Austria, Germany, and Russia, operate upon the English sugar workmen so as to prevent competition on the basis of natural advantages, and thereby deprive English producers of their right to free trade competition in their own markets, inflicting upon them the necessity of withdrawing from the unjust competition, or of giving from their own labour the equivalent of the foreign bounty."

2ND RESOLUTION.

"That diplomacy and treaty engagements having failed to stop these export bounties, it is the opinion of this meeting that it would be quite consistent with every principle of free trade to restore free trade competition to the English operative by levying against all raw and refined sugar exported under a bounty a duty equivalent to the bounty; and that such duty be at once taken off upon the abolition of bounties by any countries to the satisfaction of Her Majesty's Government."

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GREAT MEETING IN LONDON ON THE SUGAR  
BOUNTIES.

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A crowded mass meeting of working men was held in the Great Assembly Hall, Mile End Road, on the 24th of last month, to protest against the foreign bounty system. The hall was filled with workmen engaged, or lately engaged, in the various branches of sugar industry, including sugar operatives, dock labourers, coopers, and warehousemen. Mr. Ritchie, M.P., presided, supported by Mr. Stewart, M.P. for Greenock, and Mr. Andrew Dunn, of Southwark.

Letters were read from Mr. S. Morley, M.P., Mr. D. McLaren, M.P., Mr. J. Holms, M.P., and Mr. J. Samuda, M.P., all of whom expressed their sympathy with the object of the meeting, and regretted that other engagements prevented them from being present. Mr. Samuda added that "he would be glad to learn that the meeting had resulted in giving a practical suggestion for the difficulty."

The proceedings throughout were of the most orderly character, and the speeches made by the working men, of which we regret to be unable to give a full report, were well reasoned, forcible, and eloquent, and yet strictly accurate and to the point.

Mr. RITCHIE, who was heartily received, said the meeting had been called to consider the present position of the sugar refining trade, what had brought it about, the consequences to all concerned, and what were the means by which they could remedy the evil consequences now existing. On many occasions he had expressed his views on this matter; he had taken a great interest in it, and had several times brought it under the notice of the House of Commons—(cheers)—feeling, as he did, that it was a matter which was of vital importance to a very large body of his constituents. (Hear, hear.) Well, notwithstanding all their efforts for some years past, they found themselves unfortunately very much in the same position as that they were in years ago. But, as he had had many opportunities of expressing his opinions on this subject, it was not his intention that evening to go into the question at any length. He was present upon invitation, and should simply act as chairman, and see that such gentlemen as would address the meeting, should have fair play. (Hear, hear.) But, at the same time, he thought it incumbent on him to state (and he should state it very briefly) what was his opinion of the remedy which was about to be proposed for the acceptance of the meeting. They had tried hard for some years to convince the Governments of the continent that in common fairness and justice they ought to do away with the existing system, which virtually established a large bounty against the manufacturer of this country, and that they should fall back upon what was, in his opinion, the only remedy they could adopt

—refining in bond. (Cheers.) He had said that the question was much in the same position as it had occupied years ago; but that was hardly correct, because their efforts had resulted in an admission being made by every continental Government that the only remedy for the evil was refining in bond. (Cheers.) Everyone of them had at one time or other contended against that principle, but at last everyone of them had acceded to it; so that he thought he was hardly right in saying the matter was in the same position now as in years past. Indeed, he thought they had taken a great step in advance. They had shown continental Governments that no classification of any kind would be sufficient to remedy the evil, but that refining in bond, so far as they were concerned, was the only method of remedying the evil of which they complained. No doubt it was reasonable, on the face of it, that measures of classification, if fairly carried out, might be productive of good; but there was not a proposition in this respect which was not open to evasion and fraud. Therefore, the only means of effectually getting rid of this great evil was to insist on refining in bond. The continental Governments had admitted that much; but, unfortunately, when it had been attempted to carry it out to its legitimate end, some one of those Governments had invariably put its foot through the whole thing, and had expressed its inability to carry out the law in its particular country. He was afraid (although he should be the last to say they should relax or give up their efforts) that they must really look to some other means if they desired an end to the evils now existing. (Hear, hear.) The course, as he understood it, which would be proposed that evening, would be the imposition of a countervailing duty. (Cheers.) They did not desire for one moment to impede foreign refined sugar from coming into the country and competing with their own on fair terms. (Hear, hear.) They would be justified, in order to put themselves on a footing of free trade, in placing on bounty-fed sugar a duty exactly equivalent to the bounty given. (Hear, hear.) He would now point out another step gained. Some time ago a deputation waited on the Chancellor of the Exchequer in the matter, and he was sure that the meeting would agree with him that they were all much

indebted to him for the kind and sympathetic manner in which he received them. (Hear, hear.) The countervailing duty question was put before him, and he said—and in this he (Mr. Ritchie) agreed with him—that it would prove a very difficult duty to impose. Still, the Chancellor of the Exchequer did not argue against the principle; and he (Mr. Ritchie) therefore thought this another point gained. (Hear, hear.) If they could go before the Chancellor at some future time with a well-digested and well-prepared proposal for imposing the duty, he thought they would be justified in asking the Chancellor's support. (Cheers.) One other word. This bounty-fed sugar was not of advantage, even in the interests of the consumer. (Hear, hear.) He should get his sugar at the lowest possible price, undoubtedly; but the moment he began to buy it, or his bread, or anything else, below the price at which it could be properly manufactured with a fair and legitimate profit to the manufacturer, it was to his detriment and not to his gain. (Hear, hear.) The reason of this was obvious. The moment they reduced an industry to such a state that instead of making a profit the manufacturer sustained a loss, at that moment the industry would begin to decline, and would ultimately become extinct. With fewer manufacturers they would have to pay a higher price for the article. (Hear, hear.) It might be that at the present moment the consumer benefitted slightly, but in the long run (if the system were continued) he would have to pay more heavily for his goods, and the manufacture would be driven from the country. But, while they endeavoured to prosecute to success the remedy of imposing a countervailing duty, they should not relax for one moment their efforts in other directions. (Hear, hear.) In his opinion it would be quite sufficient if the Government were to hint at the imposition of the countervailing duty—(hear, hear)—and that there would be no necessity to put it in force, because, with that weapon in their hands, they might depend upon it that continental sugar refiners would come to their senses, and there would be an end to this bounty-fed sugar system. (Loud cheers.)

Mr. MONTEITH (President of the London Society of Coopers) rose

to propose the first resolution. He contended that, granted fair play, the English operative would hold his own against any foreigner who chose to enter into competition with him. (Loud cheers.) He moved—"That in the opinion of this Meeting, the doctrines of free trade require that all competition should proceed upon the basis of relative natural advantages, thereby securing to consumers the lowest natural price, approximating to the lowest natural cost of production. But the bounties given or obtained on exports of raw beet or refined sugar to this country, from France, Holland, Belgium, Austria, Germany, and Russia, operate upon the English sugar market so as to prevent competition on the free trade basis of natural advantages, and thereby deprive English producers of their right to free trade competition in their own markets, inflicting upon them the necessity of withdrawing from the unjust competition, or of giving out of their own profits and wages the equivalent of the foreign bounty."

Mr. SAMUEL PETERS, President of the National Society of Sugar Operatives (Bristol), seconded the motion, and, in a forcible speech, pictured the misery of the thousands of sugar-refining operatives thrown out of work in consequence of the odious system of admitting bounty-fed sugar into the country. He said he was lately at work at Finzel's refinery—700 men were employed; now there were seven; left to take charge of the machinery, in case, he supposed, the Frenchmen should come and take that. He asked, where were they, the operatives, to find work—what body of labour was open to receive them? Already many of his friends had died through illness accelerated by privation and exposure, and three of his fellow workmen had committed suicide. They, the operatives, could forget the past and its sufferings, but what more sad than to live without hope in the future, what more sad than to see the silent machinery and smokeless stacks of the great refineries? He pointed out that a sugar refiner, from the very nature of his work, was incapacitated, after years of labour in the refinery, from performing out-door work; and argued that the large numbers of men deprived of employment in the refineries tended to place unskilled labour at a discount. The Finance Minister of France,

M. Leon Say, paid great attention to them, the operatives, when they stated their intention to agitate for a countervailing duty unless bounties were stopped. He (Mr. Peters) felt convinced that was the only remedy, and that it would not be required twelve months, as the Foreign Governments would soon give up their bounty system. The speaker concluded by quoting the words of Cobden, that "the interest of one branch of the nation was the interest of all," and that they should "never hesitate to do what was right, even if at the time it seemed inconsistent." (Applause.)

Mr. STEWART, M.P. for Greenock, then rose to support the resolution. He said: That, having been called upon by the chairman after the first resolution had been proposed and seconded, he had much pleasure in saying a word or two in support of the resolution which had just been proposed. The town of Greenock, which he had the honour to represent in Parliament, was largely interested, as many of them knew, in sugar refining. He could not, therefore, but accept readily the invitation of their committee to be present that night to join in protesting against the unfair competition to which the British refiner was subjected by the system of bounties adopted by continental nations on the export of their refined sugars. In joining in this protest, however, he wished carefully to guard himself against being held to be detracting from the principles of free trade. The conception of the idea of free trade he held to be one of the grandest which ever occurred to the mind of man. Stated briefly, it was that wherever the special advantages of any nation under the sun enabled it to produce an article serviceable to man at the lowest possible cost, that article should be offered to the world at large free from all merely selfish or fiscal restrictions tending to enhance its cost. Now, in the belief that the fair working out of that idea would conduce to the advantage of the whole family of mankind, he, for one, was prepared to advocate the full carrying out of that principle, even if it involved the sacrifice of some sectional British interest. But the case which they were considering that night was not a natural supplanting of

a British interest by fair competition on free trade principles. It was a totally different case from that of the Coventry ribbon manufacturer, about which they heard a good deal some years ago. In his case a fair field lay open to him in competition with his French neighbour; but in this case they had not a fair field. The foreign sugar refiner had his export trade unnaturally stimulated by a bounty which enabled him to undersell the British refiner at his own door. No doubt this was done at the expense of the foreign taxpayer, to the great advantage of the British consumer; so much so, that he believed sugar refined in Paris is sold in London cheaper than in Paris. Now, if they could ensure a certainty for the continuation of this state of things, it would be vain, perhaps, in this selfish world, to expect redress, or even consideration, from the Government or the nation. But there were two points in regard to this question which it behoved those to consider who have in their keeping the interests of British commerce, and these were, first:—That much more was involved than the mere capital invested, and the prosperity of the hands employed in that special industry. The prosperity of their sugar producing colonies and of the shipping they employed were other collateral interests concerned; and the second point which should be considered was this: What would happen when that industry, almost languishing, became at last annihilated, and when, perhaps, our colonies would have to give their attention to some other cultivation than that of sugar? Was any one simple enough to believe that the foreign refiner would continue to favour them with cheap sugar? His Government at least would then see to it that he does not; and it would be sought to recoup the foreign taxpayer for past sacrifices by heavily burdening the British consumer. But the practical question was—what could they do to put this state of things right. Well, then, as one strongly imbued with the principles of free trade, he looked upon a system of refining in bond, by their foreign competitors, as the fair and legitimate and only natural way of meeting their just complaint. To bring this change about they should continue to press their own Government to urge it on foreign Governments without ceasing. He had heard their Chairman say that he would go further than



that and put on a countervailing duty. Without committing himself quite to that, he must say that, if the fair means he had stated should fail, then we must at least consider what else could be done.

Mr. ANDREW DUNN, of Southwark, also supported the resolution, although he had been cautioned, as to his public position, against countenancing a movement which seemed retrograding towards protection, but which, in his opinion, was simply advancing free trade. (Applause.) He had looked into the subject, and had come to the conclusion that such an injustice prevailed that the Government would be justified in putting a countervailing duty on foreign sugar.

Other speakers addressed the meeting, and the resolution was then unanimously agreed to.

Mr. MILES (secretary of the "Hand in Hand" Society of Coopers) then proposed the second resolution, in the following terms:—"That diplomacy and treaty engagements having failed to stop these export bounties, it is the opinion of this meeting, that it would be quite consistent with every principle of Free Trade to restore Free Trade competition to the English market, and to intercept for the Revenue the foreign bounties by levying against all raw and refined sugar exported to this country under such bounties a duty equivalent to the same. Provided that such duty be at once taken off as against any country abolishing bounties to the satisfaction of Her Majesty's Government." He said it had been stated that the foreign manufacturers owed their advantages to their superior skill. If so, what did they want with a Government subsidy? If they were ready to beat us in a fair field, with no favour, why did they not come and do it? (loud cheers.) He proceeded to explain how the bounty was given, and that it amounted to 3s. per cwt.

Mr. KELLY (Bristol Docks and Warehouses) seconded the resolution, making an excellent speech, pleading for the dock labourers, and proving by statistics that the trade of the West Indies was seriously injured by the bounty system. He made a strong appeal for support, not only on behalf of the English home industry, but also on behalf of the colonists in the West Indies, who were ever ready to help the mother country, who suffered

with the mother country from these bounties. He quoted from Cobden to show that the great free trader was not in favour of artificial cheapness, but ever insisted upon natural prices being secured for the consumer. He then refuted the opinions of Professor Fawcett, asking, if cheapness was the only rule, why not a few cheap bishops and a little cheap law? At the conclusion of his speech he was loudly cheered.

Mr. W. P. B. SHEPHEARD said, in support of the resolution, that true political economy could not regard an artificial injury to producers other than as an injury also to consumers, inasmuch as all consumption must be preceded by production. He reminded the audience of the man in the fable who killed the goose which laid the golden eggs.

After other speeches, this resolution, like its predecessor, was agreed to, *nem. con.*

The third resolution—"That copies of the foregoing resolutions should be sent to Chancellor of the Exchequer and Foreign Governments"—was proposed by Mr. Jones, seconded by Mr. Hunt, and carried unanimously.

A cordial vote of thanks to the Chairman brought this large and successful meeting to a close.

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A special general meeting of the Executive Committee of the National Operative Sugar Refiners and others connected with the trade was held on the following day (the 25th ult.), at the offices in Blackfriars Road. Mr. George Jones, secretary of the London Coopers, presided, and delegates were present from Manchester, Liverpool, Bristol, Greenock, Leith, Glasgow, Leeds, Plymouth, and other towns throughout the country, representing 70,000 workmen engaged in the sugar industries. After a very lengthy debate, a resolution was unanimously adopted, urging that every effort should be made at the ensuing general election in all the constituencies to secure the vote of the respective candidates in favour of a countervailing duty upon all subsidised sugar goods imported into the country from the Continent. Letters were read from various members of Parliament approving of this course, and the national executive adjourned.

## A REPLY TO M. SAY'S REPLY.

M. Say, in his reply to the British sugar operatives, which we give *in extenso* in another part of our present number, says:—

1. The French law is imperfectly understood in this country.
2. A part of the bounty is paid by the refiners to the manufacturers of the particular qualities of raw sugar which yield the bounty.
3. Another part goes to the French public.
4. It has been proved in the laboratories of the State that the excess yield obtained by the refiners cannot exceed 3,200 tons, which is equal to a bounty of £94,000.
5. Refining in bond would impose such inconvenience and expense on the manufacturers that it would be necessary to indemnify them, which would be the same as a bounty.
6. Refining in bond would involve a loss of 10 to 15 per cent., owing to errors of the inspecting officers.
7. The Government are therefore preparing a law founded on the system of assessment according to analysis, called the saccharimetric system.
8. The English refiners have an advantage in using Austrian raw sugar, which receives a bounty, and is, therefore, cheap.

All these statements can be shown to be erroneous. The answers to them are as follows:—

1. The records of the International Conferences which have been held on the sugar question show that the British delegates know even more about the intricacies of the French law than the French officials would sometimes appear to do.

2. An article in the *Sucrierie Indigène*, of June 20th, evidently written from the refiners' point of view, proves by elaborate calculations that the sugar contained in the various classes of raw sugar costs about the same, and that, therefore, the refiners do not, in reality, pay any extra price for particular qualities of raw sugar. The writer's conclusions are as follows:—

## 1° SUCRES ACQUITTÉS EN CERTIFICATS.

				Prix des 100 degrés.	
				Entrepôt.	Acquitté.
				francs.	francs.
1° Classe.	Sous 7,	titre moyen	75	.... 70	.. 137
2° „	7 à 9,	„	84	.... 66·67	.. 138·10
4° „	No. 13,	„	92	.... 67·39	.. 139·13

## 2° SUCRES ACQUITTÉS EN ARGENT.

3° Classe.	10 à 12,	titre moyen	90	.... 65·56	.. 138·36
5° „	14 à 19,	„	97	.... 67·14	.. 137·90
6° „	Blancs,	„	98·5	.... 67	.. 138·27

3. The price of refined sugar for home consumption in France has always been higher than the price of that exported.

The article above referred to admits this. It says:—

“Considérons, en effet, les sucres acquittés en argent, pour la consommation intérieure, et voyons ce qu'ils rapportent. La grande masse de ces sucres se compose de 10 à 12, qui d'après notre tableau produisent fr. 72·80 d'impôt aux 100 degrés, et de blancs, qui produisent 71·27. La moyenne de ces deux produits est, à peu près, de 72. Si l'exportation se faisait sans prime, si ce qu'on appelle l'admission temporaire était suivi de l'exportation intégrale des produits obtenus, l'étranger pourrait acheter chez nous le sucre raffiné à 72 fr. aux 100 k<sup>es</sup> de moins que le consommateur français. Or cet écart n'est pas de 72 fr., mais de 75 fr., puisque le certificat d'exportation se vend 75 fr., et c'est le Trésor qui fait les frais de cette différence, laquelle équivaut à une avantage de 4 p. 100 sur la moyenne des rendements légaux et à environ 5 millions de francs, soit 3 p. 100 du revenu de l'impôt sur le sucre.”

The statement of M. Say is also contradicted by the following passage from Adam Smith's well-known work:—

“A bounty on exportation imposes two different taxes on the people: first, the tax which they are obliged to contribute in order to pay the bounty; and, secondly, the tax which arises from the advanced price of the commodity in the home market.”

The French price-current bears out this statement. The price of refined sugar for home consumption is quoted 144 to 145 francs per 100 kilos. The duty to be deducted, as stated above, is 72 francs, which leaves 72 to 73 francs as the price to the French consumer without the duty. On the same day, the price of the same sugar for exportation is quoted at 69 to 70 francs.

4. It is manifestly absurd to say that the amount of the excess yield obtained in the refineries can be ascertained in a chemical laboratory. All that the French official chemists have done is to establish a system of estimating the yield of sugar, which has been proved and is now admitted to be a radically defective system. It was a former Minister of Finance, M. Pouyer-Quertier, who estimated the bounty at 20,000,000 francs; and this estimate has never been disproved. The system of assessment has been somewhat changed since then, but it still admits of the same bounty. A sugar which yields, by the official analysis, 75 per cent., is assessed as if it only yielded 67 per cent. This is a bounty of 8 per cent. But the real yield is at least 3 per cent. higher than that given by the official analysis. This raises the bounty to 11 per cent. Again, the refiner receives a credit of two or four months on the duty. This is equivalent to the Government furnishing him with his working capital, and thereby reduces his working expenses to that extent. These are what may be called the *legal* bounties, to which may be added others, such as falsification of samples. The exportation of refined sugar from France amounts to 200,000 tons per annum. The duty is about £30 per ton. Ten per cent. of this duty, a moderate estimate of the legal bounty alone, would be £3 per ton on 200,000 tons, which is £600,000. This amount may be increased, almost indefinitely, by falsification of samples and other similar devices.

There is another way in which the existence of the French bounty—admitted by numerous official committees of enquiry in France during the last six years—may be established and its extent estimated. A letter appeared in the *New Rotterdam Courant* of February 9, 1876,\* from M. Toe Water, one of the delegates of

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\* "*Sugar Cane*," 1876, page 110.

the Netherlands Government at the various international Conferences, and the leading official in Holland in connection with the collection of the sugar duties. In this letter M. Toe Water states, in the most candid and straightforward manner, that the export bounty on sugar in Holland amounts to 1,800,000 florins per annum, which is more than 30 per cent. of the duty collected. It is well known that in France the bounty is greater than it is in Holland, the French duty being higher than the Dutch. This is also proved by the fact that, while the French exports of refined sugar have more than doubled since the increase of the French duties, the exports from Holland have steadily declined, showing that the increase in the French bounty is gradually supplanting the trade created by the smaller bounty in Holland. The estimate of 20,000,000 francs as the amount of the French bounty, based as it is on reliable data of another kind, is therefore more than confirmed in this way; for that amount represents only 11 per cent. of the duty received in France.

5. Working in bond being a charge on the manufacturer, has been advanced by the French Government at several Conferences as an argument against it, but has been always at once conclusively answered.

There are more than 500 factories of beetroot sugar in France. These all work in bond, that is, under the supervision of the excise. The raw sugar goes from them to the refineries in Paris, often hundreds of miles. During the transit it is still under the care of the excise. Yet, the raw beetroot sugar manufacturers have stated, in evidence before official Commissions, that the excise supervision causes them no inconvenience or expense, but is, on the contrary, a safeguard and security to them.

. In the face of these facts it is a most erroneous and misleading statement to allege that there is any difficulty or impediment in France in establishing refining in bond. On the contrary, it is an extraordinary anomaly that the French Treasury should be so efficiently protected by a most complete system of manufacturing and refining in bond in the 500 beetroot sugar factories, which are under the permanent supervision of the excise; that the sugar

should be carefully watched by the excise officers till it reaches the refineries in Paris, and that then it should be suddenly released from all control, so that the half dozen millionaire refiners of Paris secure the large sum which the State is willing to sacrifice from its Treasury receipts under the false impression that it is thereby encouraging the whole sugar trade of France.

6. These facts afford a sufficient answer to M. Say's next objection. It is a well known and undisputed fact that this excise supervision of the 500 beetroot sugar factories is so perfect that not an ounce of sugar ever escapes. This being the case with 500 factories scattered all over the north of France, it is in direct contradiction to the long experience of one of his own departments for M. Say to assert that a similar excise supervision of half-a-dozen refineries in Paris,—under the very eyes of the central authorities,—would involve a loss to the Treasury of 10 to 15 per cent.

7. M. Say, after reproducing the fallacious arguments advanced by the French Government at the Conferences of the last six years,—arguments which have been completely disposed of, not only at those Conferences but also by French official commissions of enquiry and in the French National Assembly itself,—announces that his Government are preparing a law based on a system of assessment according to analysis. If so, the French Government are taking a course in direct contradiction to all recent international decisions, to the reports of its own Budget Commissions, and to the votes of the French Assembly. In 1873, the French Government prepared a similar law, which was condemned at every stage of its progress. They endeavoured to obtain an international Convention on the basis of that law but were defeated. In 1875, owing to the defeat of this government measure in the National Assembly, and the substitution of a law declaring that the refineries should be subjected to the same excise supervision as the beetroot sugar factories, the French Government, in pursuance of that decree, proposed that a Convention should be entered into on the basis of refining in bond. That Convention was ratified by the National Assembly, but was unfortunately rejected by the Dutch Chambers

through a misunderstanding. Holland at once endeavoured to take up the treaty again, but the French Government, released from the pressure of the National Assembly, immediately reverted to its old tactics and proposed, at a new Conference, that the idea of refining in bond,—decided on by its own Commissions, voted by its own Assembly, and proposed by itself as a basis of treaty, — should be given up, and an agreement come to on its old and exploded proposal of assessment by analysis. An elaborate report, drawn up by the French official chemists, was presented at this new Conference, held in Paris in 1876. It was very carefully examined, and the criticisms to which it gave rise led to the complete rejection of the system proposed. Holland insisted that no system but that of refining in bond would be acceptable. A combination of French senators and deputies made similar representations. The French Government was again obliged to give way, and the Convention of 1877 was drawn up, based once more on refining in bond. Holland took the lead in framing the stipulations of that document, but a new Government in that country has adopted a different policy, and prefers maintaining the old protection to its refiners to releasing them from the more highly subsidised competition of the French.

M. Say, equally desirous to protect his refiners, as the facts here stated sufficiently indicate, returns with alacrity and relief to the old story of the impossibility of refining in bond and the great advantages of "Saccharimetry."

8. The objection, that the English refiners have the advantage of being able to use raw sugar from Austria, was started by the French Government two years ago, and has been made the most of. There is really nothing in it. In the first place, France is nearer to Austria than England is; therefore the only complaint the French refiners can really make is that their own Government prohibits the importation of Austrian sugar. Again, France produces more raw beetroot sugar than she can consume. She must, therefore, export some. Whatever price Austrian raw sugar is sold at in the markets of the world must, consequently, also be the price of French raw sugar. It is, therefore, incorrect to say that because



the English refiner can obtain Austrian raw sugar, he must, therefore, get his raw sugar cheaper than the French refiner can.

Thus all M. Say's arguments are answered. They are, as has been pointed out, merely a repetition of what the French Government, whenever freed from the pressure of facts, have repeatedly urged in the interests of the Paris refiners, but have been compelled, at various times, to cease urging, owing to the light thrown on the subject by reports of official Commissions, debates in the National Assembly, adverse Parliamentary votes, and International examination of the question.

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#### A REPLY TO THE CHANCELLOR OF THE EXCHEQUER'S REPLY.

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Sir Stafford Northcote, in his well-judged and statesmanlike reply to the deputation of working men, does not, in so many words, concede the principle of a countervailing duty, but he certainly says enough to admit of such a deduction. He emphatically repudiates the views expressed so dogmatically by *The Times*, entirely dissenting from the opinion there expressed that we, as a nation, have nothing to do but to take advantage of the folly of other nations which give export bounties, and that we need not trouble ourselves as to the effect it may have on our own trade or on our future supplies. He gives an equally distinct reply to Prof. Fawcett's argument against a countervailing duty, by pointing out that the principle which forbids any legislative enactment which would prevent our obtaining those products which other countries, by means of their natural advantages, can supply more advantageously than we can, does not apply to the case of a foreign Government, by artificial action, supplying us with an article which, if things were left to their natural course, we could supply as cheaply or more cheaply ourselves. These statements, coupled with the fact that he carefully examined the practical difficulties in levying a countervailing duty, appear to justify the supposition that the principle is conceded.

But, if that be so, it is hardly necessary to make much difficulty about details. For it may be safely assumed that our Government, if it admits the soundness of the principle of a countervailing duty in this case, has only to address a note to France and Holland—who so obstinately cling to this system of protection by subsidy—saying that this country is still ready to accept an arrangement on the basis of the abortive Conventions of 1875 and 1877—of which the first originated with the French National Assembly, and the second was drawn up and insisted upon by the representatives of the Netherlands Government—but that if no such arrangement is immediately come to they will take such steps as they may think fit. France would then at once become as active a partisan for excise supervision of her refineries as she was in 1874, and Holland would be as eager to draw up a Convention on that basis as she was last year; and neither of them would again find, at the last moment, that insuperable obstacle which has hitherto always been conjured up to thwart their good intentions.

The Chancellor of the Exchequer points out, very properly, the difficulty he sees in defining the French bounty. He forgets, however, the enormous amount of sifting which the question has undergone during the last six years. Those whose interests are centred in the sugar trade must not be so unreasonable as to expect a great statesman to be master of all the details of this difficult question. It could, however, be shown to Sir Stafford Northcote, by reference to English and French blue-books, the *Journal Officiel*, and other documents, not only that the export bounty on French refined sugar is fully and officially admitted, but also that unmistakeable data exist for determining the amount of bounty which the present system affords. It can also be shown, from the same sources, that it has been repeatedly officially admitted that the only complete remedy is excise supervision of the refineries, levying the duty on the refined sugar instead of on the raw, and thus abolishing the payment of drawback. It can, moreover, be shown, from the same documents, that the existing system was actually framed with the view of giving advantages to the refiners. As to Holland, the exact amount of the bounty has been publicly stated by the lead-

ing official of the Customs and Excise Department. With the facts so far established, our Government have a sufficiently strong case. They can say to France and Holland—as, indeed, they have said through their delegates at five Conferences—“Your system, by your own showing, admits of such and such bounties; by your own admission, it was framed to give these advantages to your refiners; by the reports of your own Commissions, the votes of your own Chambers, the declarations of your own Delegates, these bounties can be stopped by abolition of drawback—levying the duty on the finished product. The experience of France, in the excise supervision of 500 beetroot sugar factories, proves that this can be done easily, efficiently, and without injury to the manufacturer. We therefore demand that drawback shall at once be thus abolished; in default of which we will take such measures as we may think fit to countervail the effect of the bounty. In making this demand, we are only asking France to carry out a law passed by her own Assembly, a promise made by her own Foreign Minister, and a Convention twice subscribed to by her Delegates and once ratified in her Chambers. Holland is similarly committed, by the declarations of her Delegates, the statements of her leading Custom-house official, a resolution of her Chamber, and a speech of the present Prime Minister.”

Then comes the question, whether the duty should be the same on all bounty-fed sugars, from whatever country and of whatever class. That would, we think, be the best arrangement. It would simplify matters; and a duty of a farthing a pound (2s. 4d. per cwt.) is too small to give rise to any complaint from the smaller as against the larger bounty-giving Governments, or from the lower as against the finer qualities of sugar. Every offending Government would have the remedy in its own hands. Abolish drawback, and the countervailing duty is immediately withdrawn. The evasion of the duty, by sending the sugar to England round by some country which gives no bounty, is not really a serious difficulty, the cost of such a proceeding representing a considerable proportion of the duty to be evaded. It would be to the interest of any country which gave no bounty to oppose in every possible way the maintenance of bounties elsewhere.

The Chancellor of the Exchequer next discusses the question, how far the sugar refining trade of this country is really affected by these bounties. He points out an increase in the exports of British refined sugar in recent years. The figures he quotes are values, not weights; and as sugar had risen far beyond its normal value at the end of the year 1876, the value of the exports in 1877 is not a fair criterion of their amount. Apart, however, from this accident, it is quite true that the very small exports of British refined sugar have somewhat increased of late years. The sugar refiners have been most careful during these six years of agitation to avoid exaggeration or misstatements, and we think it is greatly to the credit of their committee that none of their statements, so far as we can recollect, have been disproved. It is unfortunate, therefore, but not surprising, that in this movement which has just sprung up among the operatives connected with the trade, some exaggerations should have occurred, which have very naturally given rise to this criticism on the part of the Chancellor of the Exchequer. We find, on referring to the Board of Trade returns, that though the value of the exports of British refined for 1877 is higher than that for 1876, the quantities are smaller. It is perfectly true, however, that there has been an increase since 1873. The following are the weights exported in each year:—

	Tons.
1877 .....	55,977
1876 .....	59,445
1875 .....	48,613
1874 .....	46,536
1873 .....	34,839

Sir Stafford Northcote admits that these exports consist of a different kind of refined sugar to that on which the French and Dutch bounty is given; and it may also be explained that the manufacture of soft or moist refined sugar, of which these exports almost entirely consist, is an industry peculiar, so far as Europe is concerned, to this country, so that those countries which desire to be supplied with this description of sugar must come here for it. These particular statistics, therefore, appear to throw no light on the effect of the foreign bounties on our sugar refining trade. If

they be examined from another point of view, however, they will throw light on the subject, and show how much we lose, even in export trade alone, from the bounties given in France and Holland. The exports of hard sugar from France reached in one year 215,000 tons; they average 185,000 tons. From Holland 73,000 tons are exported, thus giving a total of 258,000 tons of loaf sugar exported from those two countries, against an export of 50,000 tons of soft sugar from Great Britain. The bounties given in Austria and Germany are beginning to give even those countries an export trade in loaf sugar, which is rapidly approaching 100,000 tons per annum. This brings the total yearly exports of loaf sugar from European countries up to the formidable figure of about 350,000 tons, of which 115,000 tons come to this country. The production of loaf sugar in Great Britain has been reduced by these bounties to less than 20,000 tons. The abolition of the bounties would, therefore, enable us to manufacture about 100,000 tons more for our own consumption, and give us certainly the lion's share of the remaining export trade, amounting, as we have shown, to 235,000 tons.

The Chancellor of the Exchequer is, to a certain extent, correct in saying that foreign refiners have some natural advantages, by having the raw material grown in the country; but he must recollect,—what is, in fact, the pith of the whole case,—that it is the bounties that have stimulated the production of this raw material, and that, therefore, its existence cannot be regarded as altogether a “natural” advantage. This is, in fact, the point insisted upon by the West Indian proprietors. They maintain that, without bounties, the beetroot sugar would never have succeeded to such an extent in supplanting the natural product of our colonies in the tropics.

Sir Stafford Northcote next discusses the question of refining in bond, and points out that our own manufacturers at one time objected to refine in bond. Here, again, some explanation is necessary. It is quite true that before 1864, when Mr. Gladstone so seriously reduced the duty on refined sugar as compared with the duty on raw, the refiners in this country opposed the proposal to place them under excise supervision. But in 1872, when they

petitioned the Government to procure a Convention on that basis, they not only pointed out how easily the system could be carried out, and stated their readiness to submit to it, but they actually consented, in deference to Mr. Lowe's economical anxiety, to bear all the expenses involved in establishing and carrying on the excise supervision. Moreover, the other countries cannot, as Sir Stafford Northcote suggested, argue that "it is all very well for us in England to talk of refining in bond," for it must be recollected that they have themselves talked very seriously about it. Holland has, at the last two Conferences, insisted that refining in bond is the only satisfactory mode of abolishing the bounties, and, in fact, the only system which she would accept as the basis of a treaty. France has, as is well known, actually passed a law for making her refiners work in bond, just as her beetroot sugar manufacturers do. She has promised again and again, in every form of diplomatic communication, that she will carry out that law. She has twice accepted a Convention on that basis, binding her to establish such a system. Parliamentary Committees, Budget Commission, the Superior Council of Commerce, former Finance Ministers, and, finally, the Assembly itself, have all decided, again and again, in favour of refining in bond. It is a system in full and daily operation in every beetroot sugar factory in the country, and is thus shown by practical experience to be easy to carry out, a perfect security to the Treasury, and no hindrance or charge to the manufacturer. It is no use, therefore, for France and Holland to say that it is all very well for us in England to talk about refining in bond. They are so thoroughly committed to it that no pretext or subterfuge,—however clever their negotiators may be,—can ever succeed in evading the fact.

This is what our Government ought to point out over and over again, until we drive them into acting up to their professions, carrying out their undertakings, and keeping their promises. Lord Lyons did once go so far, if we recollect aright, as to use the expression "breach of faith" in addressing a communication to the French Foreign Minister, and not without considerable effect. A little more of such plain speaking, coupled with a hint at the countervailing duty, would very soon have the desired effect.

### THE COUNTERVAILING DUTY.

At one of the meetings of the sugar operatives which preceded their deputation to the Chancellor of the Exchequer, Mr. W. P. B. Shephard was asked if he would address a letter to the Chancellor advocating the countervailing duty, which he had, in the columns of this magazine, and in other papers, so long contended for as the only effectual remedy, consistent with free trade, for restoring to our national sugar industry free trade competition on the basis of natural advantages. Mr. Shephard accordingly addressed to Sir Stafford Northcote the following letter :—

“ 24, Old Buildings, Lincoln's Inn,

“ June 27th, 1878.

“ THE RIGHT HON. SIR STAFFORD NORTHCOTE, BART., M.P.

“ SIR,

“ I understand that you have been graciously pleased to signify your willingness to receive a deputation, this day, of sugar refining operatives on the subject of the bounties granted by foreign States on the export of sugar to this country.

“ Being materially interested in our tropical sugar cultivation, I have for many years had my attention directed to this question. I crave, therefore, your kind consideration of a few points I would most respectfully urge in favour of a countervailing duty, which I would remind you, Sir, was the remedy provided by the Sugar Convention of 1864.

“ You, Sir, must, I am afraid, admit that diplomacy has failed to redress the grievance. Hence fiscal action demands attention; because it can hardly be conceded, as consistent with sound commercial policy, that our free-trade industries are to be diverted by aggressive foreign protection from their natural sphere of operation in this country.

“ A fundamental and unassailable principle of free trade demands that natural advantages of soil, situation, climate, and industrial skill should govern production and distribution, and should form the basis of all competition, thereby reducing cost of production to

a minimum, and, by free competition, securing to the consumer the full benefit of such natural advantages.

"I ought to apologise for reminding you, Sir, of such a trite economic truth. But there are those who ignore this principle which vindicates free trade, and, when our sugar industry, in reliance on it, asks for redress against State subsidies to rival producers, view their just appeal with suspicion and contempt as a demand for protection.

"The export bounties, which check the harmonious working of our sugar industry on free-trade principles, flow from the treasuries of foreign States. As the bounty enters our market, it compels its equivalent from the English free-trader as the condition of his competition.

Impose a countervailing duty, and the bounty is intercepted for the revenue. The consumer loses what he was not entitled to, and the taxpayer gains. Probably the bounty is stopped.

"This is free trade, with free competition on the basis of natural advantages.

"On the other hand, let the bounty operate on our markets; the consumer pockets it so long as the English producer can maintain the competition by providing the equivalent. This equivalent of the foreign subsidy operates as a tax on his profits, already adjusted to a minimum by free-trade competition. Consequently our free-trade producers are gradually supplanted in their own markets by foreign protectionists.

"This surely is not free trade.

"I have the honour to remain, Sir,

"Your most obedient and humble servant,

"WALLWYN POYER B. SHEPHEARD."

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The sugar crop of British Guiana for 1877 showed a deficit of about 10,000 hogsheads as compared with the previous season, and it is feared that the weather conditions are such that the yield during the ensuing season will fall short of the average. The "wet season," which ought to have set in at the end of November, was practically delayed for two months, and the scarcity of rain, at the time when it was principally required, coupled with the unusually small quantity that fell during the dry months, from July to December, threatened to seriously affect the growing canes.



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MR. COBDEN ON NATURAL PRICES.

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Those who contend that it is a benefit to the nation to have prices artificially lowered by foreign export bounties must not claim kinship in free-trade views with Mr. Cobden, as is evident from the following quotations from two of his speeches, which we extract from the recent edition of Cobden's Speeches, by the Right Hon. John Bright and Professor Thorold Rogers:—

“Now, let me be fully understood as to what free traders really do want. We do not want cheap corn merely in order that we may have low money prices. What we desire is plenty of corn, and we are utterly careless what its price is, provided we obtain it at the natural price.”

“We do not seek free trade in corn primarily for the purpose of purchasing it at a cheaper money rate; we require it at the natural price of the world's market, whether it becomes dearer with a free trade—as wool seems to be getting up now after the abolition of the 1d. a pound—or whether it is cheaper, it matters not to us, provided the people of this country have it at its natural price, and every source of supply is freely opened, as nature and nature's God intended it to be;—then, and then only, shall we be satisfied!”

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WHAT THE SUGAR BOUNTIES ARE DOING.

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The following letter appears in the *Morning Post*. It is so remarkable for concentrated point that we reproduce it:—

“SIR,—To transfer a source of supply from the natural, the certain, and the cheaper to the artificial, the precarious, and the dearer zone of cultivation, with competition proceeding at a higher level of cost of production, thus transferring to the consumer of to-morrow the burthen of the protection which, bribe-like, advantages the consumer of to-day; to shift competition and market values from that adjustment, ever beneficial to consumers, which

results from competing relative natural advantages; to lower prices below their natural level by a State subsidy to one set of competitors, thus compelling its equivalent from, or the withdrawal of, all other competitors; to check tropical cultivation and divert English capital and labour there and at home from a natural sphere of industry; to leave a merchant fleet idle and our quays without their cargoes; to enable the protected and therefore inferior beet sugar to ride rampant over the natural bounty of our tropics, which, under free trade, needs no other protection than its own intrinsic merits;—to do all this, with much specific misery, unchecked notwithstanding diplomacy, despatches, and blue-books, and more too, is what the sugar bounties are doing.

“I am, Sir,

“Yours obediently,

“W. P. B. S.”

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[COMMUNICATED.\*]

### BARBADOES.

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We know no better or other mode of dealing with the vague generalities which are again and again reproduced to the prejudice of Barbadoes than to print such ascertainable facts as refute them.

One such generality alleges that the interests of the labouring population are not represented in the Representative Assembly.

The following is a copy of the List of Voters in one of the electoral districts. It is the only one we have, and the weakest for our purpose, and yet sufficient to show that the voice of the labouring classes must be heard in the Assembly.

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\* We willingly give insertion to this article, although declining responsibility for opinions expressed on merely political issues. Our only interest is the real welfare of the West India Colonies, and our pages will always be open to the free discussion, without party bias, of all questions concerning their well-being.—ED. “SUGAR CANE.”

## 1876.—LIST OF REGISTERED FREEHOLDERS IN THE PARISH OF ST. JOHN.

Names.	Land Owned.			Highest Amount of Taxes Paid.	Complexion.	Occupation.
	A.	R.	P.			
Antrobus, John Henry ..	2	1	0	\$1-62	White ..	Inspector of roads.
Brooker, George Grant ..	4	0	0	2-88	White ..	Horse and cattle dealer.
Callender, Thomas ....	0	2	0	0-36	Black ..	Cooper on Clifton Hall estate.
Cheesman, James Parris ..	32	0	0	23-04	White ..	Millwright.
Clarke, George Forster ..	5	1	0	3-78	Coloured	Mason.
Connel, John .....	58	2	0	42-12	White ..	Proprietor of Halton estate.
Cronsey, William Francis	31	1	11	22-55	White ..	Proprietor and shopkeeper.
Gibson, Richard Francis	1	2	0	1-08	White ..	No occupation.
Goddard, Joseph Wm. ...	0	1	0	0-18	White ..	Butcher.
Greaves, Michael Thos. .	99	1	0	71-46	White ..	Proprietor of Edge Cliff estate.
Grosvenor, James .....	3	3	0	2-70	Coloured	Master mason.
Hart, Henry Francis ..	198	0	0	142-56	White ..	Proprietor of Ashford estate.
Haynes, Wm. (absent) ..	418	2	0	301-32	White ..	Absentee proprietor.
Haynes, Joseph Alleyne.	656	0	0	472-32	White ..	Propr. & Memb. of Legis. Council.
Haynes, Henry .....	10	0	0	7-20	Coloured	Overseer on an estate.
Haynes, Ed. Lee (absent)	450	3	0	324-54	White ..	Absentee proprietor.
Holder, Henry Jones ..	1	0	0	0-72	Black ..	Hawker of bread.
Howard, James Anthony	1	0	0	0-72	White ..	Master blacksmith.
Husbands, John Richard	0	1	0	0-18	Black ..	Carpenter.
Inniss, Benjamin .....	88	3	0	63-90	White ..	Proprietor and merchant in town.
Lashley, John Edward ..	0	1	0	0-18	Coloured	Mason.
Lyall, Charles Fryer ..	222	1	28	160-15	White ..	Absentee proprietor.
McConney, Francis ....	0	3	0	0-54	Black ..	Estate labourer.
Massiah, Will Chris. ...	24	1	0	17-46	White ..	Proprietor of Carless estate.
Massiah, James Phillips.	51	3	0	37-26	White ..	Proprietor & Parochial Treasurer.
Mayers, Thomas .....	0	1	0	0-18	Coloured	Carpenter.
Niccolls, John Robert ..	7	1	0	5-22	White ..	Millwright.
Niccolls, Samuel James .	1	0	0	0-72	White ..	Retired blacksmith.
Norris, John William ..	1	0	10	0-77	White ..	No occupation.
Parkinson, Thos. Henry	0	1	20	0-27	Coloured	Cabinetmaker and undertaker.
Pilgrim, Thomas Forster	13	0	0	9-30	White ..	No occupation.
Pilgrim, Henry .....	12	2	0	9-00	White ..	Planter.
Reid, Joseph Ambrose ..	2	3	0	1-98	Coloured	Shopkeeper.
Riley, Francis .....	1	0	0	0-72	Coloured	Millwright.
Robinson, Richd. Henry	6	3	0	4-86	White ..	Postmaster.
Sealy, Sir John .....	226	0	0	162-72	White ..	Propr. & Memb. of Legis. Council.
Sealy, John, M.D. ....	38	0	0	27-36	White ..	Doctor & Memb. of Legis. Assem.
Sealy, George .....	55	2	0	39-96	White ..	Planter & Memb. of Legis. Assem.
Sergeant, Jos. Lewis ..	99	0	0	71-28	Coloured	Proprietor of Ventur estate.
Stuart, Benj. Francis ..	3	0	0	2-16	Black ..	Schoolmaster.
Thompson George ....	0	3	0	0-54	Black ..	Labourer on an estate.
Thomas, Grant Elcock ..	300	0	0	216-00	White ..	President of Legislative Council.
Toppin, Walter A. ....	181	0	20	130-41	White ..	Proprietor of Rasgur estate.
Trollope, Major-Gen. Sir Charles (absent) ....	365	2	0	263-16	White ..	Absentee proprietor.
Weekes, John William ..	1	0	0	0-72	..	..
Wiggins, Thos. Richard	0	3	0	0-54	Black ..	Mason.

May 21, 1876.

JAMES MASSIAH, Parochial Treasurer.

The male adult population of Barbadoes amounts to 2,500 men. About 1,300 now are voters. More might vote if they cared to register.

The following statistical analysis is a curious commentary upon the alleged absence of representation of the interests of the labouring classes, considering that many of the white and most of the coloured and black voters are labouring men in the true sense of the word.

*Voters in Barbados according to Register, 1875.*

Parish or Town.	White.	Coloured.	Black.	Total.
St. George ... ..	51	18	36	105
St. Joseph ... ..	48	14	15	77
St. Thomas ... ..	46	20	34	100
St. John ... ..	29	9	8	46
St. James (c) ... ..	45	13	32	90
St. Lucy (a) ... ..	50	18	11	79
St. Peter (b) ... ..	37	4	6	47
St. Philip (e) ... ..	60	39	60	159
*Christ Church ... ..	...	...	...	...
St. Andrew ... ..	25	2	2	29
*St. Michael ... ..	...	...	...	...
*Bridge Town ... ..	...	...	...	...
* No returns in our possession.				
<i>Not Registered.</i>				
(a) in this parish there are...	7	2	5	14
(b) " " ...	37	4	6	47
(c) " " ...	8	7	11	26
(e) " " ...	15	6	3	24
These cannot Vote.				

#### TAXATION ON FOOD.

Let us look now at the taxation, and observe how the pockets of the labouring classes are taken care of:—

1. By Crown Nominees in Jamaica.
2. By " " in Antigua.
3. By the Representatives of all classes in Barbadoes.

Taxed Food of the Labouring Classes.	Jamaica. Crown Colony.	Antigua. Federated Colony.	Barbadoes. Representa- tive Govt.
	s. d.	s. d.	s. d.
Alewives, per barrel ..... (small salt fish.)	2 6	2 0	0 4
Bread and Crackers, per 100 lbs. ...	6 0	2 0	0 5
Corn Meal, per barrel .....	2 0	2 0	1 0
Flour, per barrel .....	8 0	5 0	3 6
Cod Fish, per cwt. ....	3 11	1 1½	0 2
Herrings, per barrel .....	2 6	2 0	0 4
Salt Meat, per cwt. ....	7 6	4 8	4 8
Rice, per cwt. ....	3 4½	2 0	0 5

#### ADMINISTRATION OF JUSTICE.

We remember that the present Common Sergeant of the City of London (Mr. Charley, M.P.,) stated in the House of Commons, in that speech in which he vindicated the constitution of Barbadoes against the attack of Mr. Pope Hennessy, that if a manager were to box the ears of a negro boy he would be sued for damages in 24 hours.

It is evident from the following letter of the late Queen's Solicitor for the island that the labouring population in Barbadoes are in the enjoyment of legal rights far in excess of those enjoyed by the labouring population of the United Kingdom :—

“TO THE EDITOR OF THE ‘MORNING POST.’

“Sir,—Perhaps you will permit me, as a solicitor who for upwards of 30 years has been practising in Barbadoes, to state a few facts with reference to the administration of justice in that island. I venture to ask this as I perceive a growing misconception in some of the public prints with reference to the position of the labouring classes in Barbados. I can assure you that in Barbados there is literally and truly no distinction of persons in the eye of the law.

“In case it may be said that laws are one thing, but that their administration is another, I will briefly point out the character of our judicial establishment. There is, first, a chief judge, who composes the Court of Chancery, the Court of Common Pleas (which includes the Court of Bankruptcy), the Court of Probate, the Court of Admiralty, and the Court of Grand Sessions and General Gaol Delivery. The civil courts are held at

frequent intervals. The Court of Grand Sessions and General Gaol delivery is held three times a year, viz., in April, August, and December; in case of necessity the Governor can hold a court at any time. A grand jury and two petty juries are summoned for this court. The juries comprise persons of all colours. So much for the higher tribunals of justice. The administration of the smaller tribunals has a more important bearing on the interests of the lower classes. I can state as a positive fact within my own daily experience that the labouring classes in Barbados have the greatest confidence in the tribunals to which they resort. Indeed they bring before the magistrates the most trifling matters for decision. The summons only costs them a shilling in a civil case, and nothing at all in a criminal matter. The rural part of the island is divided into five legal districts, and the chief port and capital, Bridgetown, forms a sixth. In each district a stipendiary magistrate sits daily. He possesses, in addition to his general criminal jurisdiction, a civil jurisdiction for debt up to £20, and for damages up to £10. From the decision of these magistrates there is an immediate appeal to the Assistant Court of Appeal, which sits four times a week, and oftener if required. This court of appeal is really a court of review, inasmuch as the cases are reheard both with respect to law and facts. The evidence taken in the court below is adduced, and the witnesses are again examined and cross-examined. Moreover, all the stipendiary magistrates are compelled by law to make a return of all cases heard before them on the 1st and 15th of every month to the Assistant Court of Appeal, and this latter court can, although the parties themselves have not appealed, summon them before the court, and correct by a fresh adjudication any error in judgment or mistake in law. There is also an appeal from this court to the chief judge. All judges and magistrates are appointed by the Crown. Nothing can have worked better than this establishment, which has been in operation for just 40 years. The expense of litigation is, so far as court fees are concerned, trifling. As a general rule the labouring classes conduct their own cases before the magistrates and the Court of Appeal. In conclusion, I can confidently say that the administration of justice in Barbados is settled on a very sound footing, and is both cheap and expeditious.

"I am, Sir, your obedient servant,

"SAMUEL TAYLOR,

"Queen's Solicitor for the Island of Barbadoes,

"80, Upper Gloucester Place, Dorset Square,

"May 9, 1876."

We cannot but believe that Sir Michael Hicks Beach will ever require that the truth, the whole truth, and nothing but the truth shall find its way across the Atlantic into the portals of the

Colonial Office, in order that the colony may rest in confidence upon the home Government. Then, and then alone, will the successive Governors of the Windward Islands be relieved of the invidious office of having to carry out a policy which could scarcely be justified were the facts even as they are alleged to be, but which upon the facts as they are, perishes in its own inutility to any useful end for sound government, whether administrative or legislative,—a policy which was calculated to destroy that free and liberal Constitution of Barbadoes, an historical vindication of which appeared in our last issue. A policy which, upon the assurance of Her Majesty's Secretary of State for the Colonies, we believe has been most wisely abandoned.

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#### IMPORTANT QUESTION AND MOTION IN PARLIAMENT.

(25th July, 1878.)

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Mr. JAMES STEWART asked the Under Secretary of State for Foreign Affairs whether Her Majesty's Government were urging the Governments of France, Belgium, and Holland to adopt a system of refining sugar in bond in lieu of the present system, which operates as a bounty on the export of refined sugar.

Mr. BOURKE said the Government had never omitted any occasion to urge upon the Governments mentioned by the hon. member the expediency of adopting the system of refining in bond; and negotiations had been going on for some time on the subject. Those negotiations had come to an end in consequence of the Dutch Government refusing to adopt the system.

Mr. RITCHIE, with reference to the the answer given by the Under-Secretary of State for Foreign Affairs on the question of the bounty on refined sugar, that negotiations were now at an end, gave notice that on an early day next Session he would call the attention of the House to the subject, and move a resolution to the effect that a countervailing duty should be levied on all sugar imported from countries in which the system of refining was such as practically to confer a bounty on the export of refined sugar, such countervailing duty to be an exact equivalent to the bounty.

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FERMENTATION.

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We extract the following from a paper on "Fermentation and Putrefaction," by Mr. Thos. McKean, F.C.S., in the *Brewers' Guardian* :—

Those experiments show that if atmospheric air be purified, either by filtering through asbestos and cotton or heating it to redness, it may be introduced and remain in contact with a saccharine solution for an indefinite time without producing fermentation. It must, of course, be distinctly understood that no atmospheric air is admitted into the flasks of saccharine juice either before, while, or after performing those experiments. Suppose we follow Pasteur a little further in his experiments, and introduce a piece of the cotton or asbestos, already used in the experiments, into another flask of fresh juice, which has been boiled and cooled, and which contains the albumenoidal and mineral constituents of yeast. Fermentation will develop, and will continue, with the admission of air, till all the sugar is reduced. In this experiment we have transferred the spores of yeast, which we had collected on the asbestos or cotton, to the flask of saccharine juice, which is nutriment necessary for their development. Hence the fermentation.

Helmholtz remarks that fermentation only takes place when the solution of sugar is sufficiently diluted with water. With less than four parts of water to one part of sugar it takes place but imperfectly, if at all. This is partly owing to the fact that the resulting alcohol precipitates the nitrogenous substances, destroys the fermentative power of the yeast, or renders the liquid unfit for its further development. If, on the other hand, the liquid is too dilute, the fermentation is slow, irregular, and readily passes into acetous fermentation. I think this last observation of Helmholtz can practically be applied to the "washings" of the charcoal in a sugar refinery. When the sugar liquor, which is "run" over charcoal for its purification, has been partially drained from the charcoal cisterns, in a sugar refinery, condensed boiling water is introduced to wash out of the charcoal any of the remaining liquor. This, after it comes out of the cistern,



is called "sweet water," and by repeated or continuous washing with water, almost all the liquor is expelled from the cistern. The refiner collects the sweet waters till they become so diluted with water, that to extract the sugar by evaporation would not return remuneration for his trouble, so he turns them into the "street," that is, he allows them to run to waste, and it is in those "washings," or waste waters, that may be observed the acetous fermentation already referred to. If they are allowed to stand in a cistern (or by taking a portion in a flask will equally serve the purpose) for an half-hour or so, a "muddiness," or slight precipitate, will form, which may without doubt be termed nitrogenous, and a sour acid smell will be perceptible.

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## PUBLIC SANITATION AT KRALINGEN.

By H. C. MATHESON.

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Adjacent to Rotterdam is the village of Kralingen, which in sanitary matters is in advance not only of most Dutch towns, but also of the largest towns of England. Small as it is, with a population of 10,000 inhabitants, and small as are the funds at the disposal of its town council, the corporation has been sufficiently enterprising to move out of the old groove, and adopt throughout the municipality a system of "charcoal closets."

Each house is furnished with a charcoal closet (and the closets are usually placed within the house), and on the outskirts of the village is the health yard, where the various operations of washing the pails and disposing of their contents, together with the preparation or manufacture of the charcoal, are carried on.

Housekeepers are allowed to dispose of dirty water from washing, &c., in the canals, either directly or through sinks communicating with them; but they are not allowed to dispose of ashes, and vegetable or other dry refuse, in the same way. These latter, such as in most English towns would be thrown into the ashpit, are here set aside in a box or barrel, and at regular intervals they are called for and taken to the health yard—or charcoal yard, as it might

be named—to which place, too, not only the pails, but road sweepings and market refuse are also conveyed.

In the closets the discharge of a small quantity of charcoal upon the surface of the contents of the pail is usually automatic, but it is occasionally caused by means of a handle, as in the ordinary watercloset, both varieties being in use. The pails are changed twice a week. The men from the yard who perform this duty are always clean and tidy in their dress and persons. They have just a touch of uniform in the brass badge on their hats. In summer they come round with boats and handcarts, and in winter with horses and carts. On leaving the yard to make a round they take as many clean pails as the boat or cart will hold, each containing sufficient charcoal to serve a closet for the half-week, and with each pail they take a cover. At each house the process is as follows:—A clean pail is taken in, and the pail which is now removed from the closet is at once covered with the lid from the clean pail; the fresh charcoal is placed in the hopper at the back of the closet, and the clean pail is put in the place of the one just removed. These operations are all effected by the men who convey the pails. The filled pail is then carried away, and the closely-fitting lid, together with the admixture of charcoal, completely prevents any smell from escaping, either in the house or the street. On reaching the charcoal yard the contents of these pails are emptied into store tanks, and before the pails and lids are again employed they are thoroughly washed and brushed. They are, in fact, carefully and completely cleansed, and scrubbed as carefully as if they were dairy cans. The excreta collected, mixed as they are with charcoal, are eventually used as manure.

The “charcoal” which is used for the closets is obtained from street sweepings and market refuse, and the ashes and other refuse collected from the houses. Until very recently these were treated in cast-iron retorts, which, notwithstanding many serious defects, did succeed in evolving a quantity of charcoal, though of a poor quality. These retorts, however, while consuming considerable quantities of coke, gave but little charcoal; and from the nature of their arrangement the brickwork settings required frequent

repairs. Lately, by the advice of Mr. Harting, the manager of the yard and chief sanitary inspector, the Town Council have put up one of Fryer's Patent Carbonisers to replace the retorts. This, together with a charcoal cooler and a chimney, was erected for them by Messrs. L. A. L. Kortman and Co., of Rotterdam, the agents in Holland for Messrs. Manlove, Alliott, and Co., the makers of the patented apparatus. This carboniser has many advantages over the old retorts. The process is continuous, thus avoiding the great waste of heat inevitable with the retorts, which had to be thrown completely open to withdraw the charcoal. More charcoal is now produced, and of a better quality. The process can be perfectly regulated, and the brickwork is much more advantageously arranged for resisting the heat, thus reducing the number of repairs.

At Kralingen much credit is doubtless due to the ability and thoroughness of Mr. Harting; but it is perfectly evident that under similar conditions this system will always prove a success if properly worked. The system is to be commended for its healthiness, cleanliness, simplicity, and economy. *The closets are free from bad smells, and the houses from any liability to invasion by sewer gases.* The change of the pails is easily and quickly effected without smell; no longer permitted to pollute the canals, the ashes and the vegetable and other refuse are not only got rid of, but are turned to some use; no offensive odour escapes from the pails during transport, even in the health yard itself there is but little smell; and, lastly, the system is not expensive.

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Rotterdam, 13th June, 1878.

Messrs. MANLOVE, ALLIOTT, & Co., Nottingham.

Dear Sirs,

We have to thank you for your esteemed favours of 11th May, 8th and 11th June, which came duly to hand. You therein ask our opinion about the 8-cell carboniser and cooler, Fryer's patent, delivered through you at Kralingen. We found the working of the carboniser and cooler *perfection*; and our own opinion of the said carboniser being very favourable in every point, we asked the opinion of Mr. Harting, manager of the health

works at Kralingen. We had to wait a long while for his report, and received this report only yesterday. We beg to enclose translation of this official document, and to say that the carbonisers formerly used at Kralingen were built according to the ordinary system of gasworks furnaces. These furnaces proved to be unsatisfactory as to production and quality of the charcoal.

The old furnaces produced, with 25 hectoliters of coke (half a florin), 25 hectoliters charcoal; each hectoliter charcoal produced thus costing half a florin in fuel.\* The present improved furnaces produce, with 25 hectoliters of coke dust (one-tenth of a florin per hectoliter), about 125 hectoliters of charcoal; each hectoliter charcoal produced thus costing one-fiftieth of a florin.†

The price of charcoal, new system, compared to the price of charcoal, old system, is from 1 to 25!

We hope these facts will satisfy you as well as they do us, and we feel sure that it is impossible for corporations to find a more simple, economical, and effective means of carbonising street sweepings.

We remain, dear sirs, yours faithfully,

L. A. L. KORTMAN & Co.

[TRANSLATION.]

Kralingen, 11th June, 1878.

Messrs. L. A. L. KORTMAN & Co., Rotterdam.

Dear Sirs,

Replying to your esteemed letter, I am glad to be able to send a favourable report of Fryer's patent carbonisers.

Though I received a favourable impression at my first visit to Manchester and Nottingham, where I made the acquaintance of Mr. Fryer, I can say that the results are much more favourable than I expected.

The carbonising of house and streets sweepings is effected to *perfection* through Fryer's carbonisers.

As I have been experimenting with carbonising street-sweepings during a long time according to other methods, the extraordinary results of this method can only give me the greatest satisfaction.

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\* Equal to 6s. 3d. per cube yard.      † Equal to 3d. per cube yard.

The carbonisers are economical in fuel, have an immense production, and in the nearest neighbourhood there is no smell whatever.

A careful inspection of the carbonisers after four months' use (day and night) proves that nothing of the material has suffered in the very least. I may thus conclude that no repairs whatever are to be expected.

The fuel used at present is coke dust, costing 10 cents (or two-pence) per hectoliter. This fuel has proved, after experiments with several kinds of fuel, to be the most economical. I use for the eight cells, during 24 hours, about 25 hectoliters;\* the drawing and filling can then take place regularly. The eight cells thus working produce 120 to 150 hectoliters excellent charcoal.†

The cooler, though making excellent work, is not very often used, as we had some arrangements to sieve and grind the charcoal. The steam-engine of the cooler has been arranged through me to drive an elevator, and deals with the cooler and the elevator easily. The elevator lifts about 300 hectoliters of street sweepings on to the platform.

The whole carboniser is worked day and night with only three men, and the carbonisers are so simple that they require no special superintendence.

The Fryer's furnaces are perfection, and agree in all points to the purpose which the esteemed inventor has proposed to himself.

I trust that the results reported will be as agreeable to you as they are to us.

I remain, yours truly,

(Signed) HARTING,

The Manager of the Sanitary Works, Kralingen.

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### ECONOMY OF FUEL.

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Until a motive power is discovered which can be substituted for steam, it is important we should make efforts to economise our coal supply—and considering the immense quantities of coal daily

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\* Equal to 36 cwts, or 21 lbs. coke dust per cell per hour.

† Equal to 423 to 540 feet, or 2.2 to 2.8 cube feet per cell per hour.

consumed for producing steam, it becomes a question of how we can obtain the greatest available power from a minimum weight of coal. Much has been done of late years in the way of improving the form of boilers, by increasing their heating surface; but few successful attempts have been made to prevent loss of heat by radiation, or to protect the inner surface of the boiler from incrustation. We believe the most successful remedy yet discovered for the former is Leroy's Non-Conducting Composition. This is said to save from 15 to 20 per cent. in fuel, and is preferable to felt for the following reasons: 1. It adheres to the iron and other metals, and does not permit the heat to escape, or the air to penetrate through. 2. It will last a much longer time. 3. It need not be removed to examine the state of the boiler, as it will show the least leak at once. 4. It cannot catch or communicate fire. 5. It completely preserves the iron from rust. These valuable advantages have been attested by a great number of large manufacturers, and we are informed that the patentees have also received testimonials from H. M. Dockyard at Portsmouth, from many large iron companies, and from steamship owners, including one from the engineers of the "Great Eastern" steamship.

Many non-conducting compositions have been invented, but Messrs. Leroy's is, in our opinion, the most effective. It is one of the oldest which is in use, and has from time to time been improved by them, and better machinery for mixing it has been devised.

Perhaps even more important than the prevention of loss of heat by radiation from the outer surface, is the prevention of incrustation on the inner surface of boilers. This formation is very rapid, and not only acts as a non-conductor of heat inside the boiler, but involves the risk of gradual damage to the boiler by the periodical operation of chipping it out. A large boiler takes a considerable time to cool before a man can safely enter to remove the incrustation—and even then, the process of chipping is very laborious and slow, causing, meanwhile, loss of time.

It has recently been discovered that if plates of cast zinc (or spelter) are suspended in a boiler, the calcareous matter loses its cohesion, and does not adhere to the boiler-plates, but is

deposited in the form of powder or mud, which can readily be pumped out. These plates are about 12 inches  $\times$  6 inches  $\times$  1 inch thick, and are cast with two holes of about one inch diameter, through which iron clips are attached, and they are suspended in the boiler. In a moderately-large boiler three or four such plates are suspended—and they are estimated to last about two months. As zinc deteriorates every time that it is re-melted, it is desirable to employ, for the above-mentioned purpose, original spelter, and not plates made from refuse, etc. The best is imported from Belgium.

We understand that the Admiralty have ordered all boilers of the steamships of the fleet to be fitted with these plates.—*The Journal of Applied Science.*

The following table shows the decrease in the importations of refined sugar, and the increase in the importation of raw sugar into Italy; exhibiting the development of the refining industry in that country.

	Refined. Tons.		Raw. Tons.		Total. Tons.
1870 .....	53,748	...	14,621	...	68,369
1871 .....	56,972	...	14,146	...	71,118
1872 .....	53,817	...	16,401	...	70,218
1873 .....	51,014	...	29,752	...	80,766
1874 .....	45,092	..	34,302	...	79,394
1875 .....	43,129	...	37,852	...	85,981
1876 .....	42,384	...	37,340	...	79,724
1877 .....	37,361	...	47,404	...	84,765

According to M. M. Rueb and Ledeboer, of Rotterdam, the following is the proportion of the different classes of sugars consumed in Holland, taken on the whole:—

	No. 19 to 20 per cent.		15 to 18 per cent.		10 to 14 per cent.		7 to 9 per cent.		6 & under. per cent.
1868 .....	2.86	...	31.20	...	55.30	...	6.82	...	3.70
1878 .....	.63	...	1.90	...	45.71	...	45.66	...	6.11

The low sugars of from 7 to 9 have increased 38.94 per cent. and the sugars under 6.14 per cent. thus showing that the Dutch refiners must find it very advantageous to work this class of sugar.

VISIBLE SUPPLY OF SUGAR.

Stocks—	1878. Tons.	1877. Tons.	1876. Tons.
Great Britain .....	194,673	.. 168,767	.. 187,352
France .....	84,887	.. 108,459	.. 118,472
Holland.....	34,983	.. 19,047	.. 33,038
Germany .....	24,170	.. 18,000	.. 25,470
United States .....	84,791	.. 122,836	.. 105,636
Havana and Matanzas ..	92,900	.. 106,000	.. 90,920
Sugar afloat .....	49,016	.. 71,154	.. 46,400
Totals .....	<u>565,420</u>	<u>614,263</u>	<u>607,288</u>

Correspondence.

Spring Garden, Jamaica,

20th June, 1878.

TO THE EDITOR OF "THE SUGAR CANE."

SIR,—I am glad attention is being given to the diseases of the sugar cane, and I hope the example of Queensland in the matter will be followed by other cane producing countries.

I have given a great deal of attention and devoted some time to an examination of the injury done by the sugar cane louse, or *Pou blanc*, from the ravages of which I have occasionally suffered much. This year my canes have been much attacked by the insect in certain fields, whilst in other parts of the cultivation none have appeared. I have tried to account for this, and as I think I have found the solution, it may be interesting to some of your readers that I should say a few words on the subject.

I have suffered more or less for seven years from this *Pou blanc*, and I have tried to exterminate it by the free use of lime on the land, by steeping the cane plants in cream of lime, in carbolic acid (crude acid) in the proportion of one quart to 150 gallons of water, in sulphuric acid and water, and by laying the cane tops on the



ground and sifting over them ashes and slaked lime, separately and together, and lastly by hand-wiping each top with a soft damp piece of cloth. All of these did more or less good, but I prefer the latter, although the most costly and most laborious, as the most effective and most remunerative. But prevention of the spread of the disease is not enough. If a plantation is to escape injury there must be no insects any where within travelling distance. But then lice are active and can travel rapidly and far. They delight in dull moist weather and during the rainy season, which has been unusually long here this year, they have increased marvellously. They seem to be guarded, protected, even conveyed, by ants. The ant is devoted to the cane louse. As Professor Van Beneden says, page 266 of his book "Animal Parasites and Messmates" (Vol. 19 of Kegan Paul's Scientific Series), "Much has been written about these small sugar manufactories so well known by ants that they have procured for the aphid the name of ant cow." It is comical to see the ants sucking their cow, and scraping their backs with their mandibles.

Within the last ten days we have had, here, hot bright sunshiny weather, and observing some canes, which I knew were covered with lice, looking sickly and rusty, I examined the plants carefully. I was surprised to find comparatively very few lice, and I began to think some other disease affected the cane; but seeing no ants on the canes, it occurred to me to search the roots. Here I found the earth had been ploughed up by the ants and was as soft as an ash heap, and, of course, more damp than elsewhere. Rooting up the cane I found lice and ants by millions;—driven from the cane tops by the glare or heat of the sun, the lice had gone to the roots. Every young rootlet was either nipped off or injured, as well on this plant as many others which attracted my attention by their sickly appearance. Only the old hard roots were untouched. No wonder the leaves wither and rust, and the canes suffer, seeing that all the feeding rootlets of the plant are destroyed.

As canes are cut usually in fine weather, the lice are then, probably, safely hidden away under ground, and to set fire to the field is to lose valuable vegetable matter without doing much in destroying the insects.

I have said that parts of the cultivation are quite free from *Pou blanc*, and the parts are those which a year or two ago suffered most from the louse. Why this immunity now? This puzzled me for a long time until I observed on the leaves of some vines of the Bona vista pea (*Dolichos lablab*) thousands of ichneumon flies. These hymenoptera were my friends. They plunge their ovipositors into the aphid-larvæ and "the young ichneumon devours its nurse piece-meal, organ after organ, and for fear that death should supervene too quickly the mother ichneumon takes care to chloroform the victim (louse) to make her last longer." (Van Beneden, p. 163.) I have not observed these ichneumons in any other part of the cultivation except this in which the canes are free from disease, although I have looked for them!

I do not know why this is; except that I have no other plants of the Bona vista bean growing except hereabouts. If planting the *Dolichos lablab* will bring the ichneumons to the diseased portions of the cane fields, and I am right in thinking they are the exterminators of the *Pou blanc*, the sugar planter will owe an immense debt of gratitude to this ichneumon, as he does to that other ichneumon, the mongoos, of which I wrote you last year.

I intend planting the *Dolichos lablab* as a green dressing on each field of canes to be planted next year; and I am now planting rows of them around my young plants, placing poles for them to twine upon like hops. I believe and hope that by doing so I shall gather together such an army of ichneumons as will free me of the *Pou blanc*, if not altogether, at least considerably.

I shall be glad if any other sugar planter will try the effect of this plan, and let me know the results. Later I will trouble you again on the subject. In the meantime, if I am right in my theory, there should not be much, if any, *Pou blanc* in Barbadoes, for, there, Pigeon peas, sweet potatoes, and other plants, on which I have seen ichneumons, are regularly planted. Perhaps some Bimshire man will kindly tell us what he knows on the subject.

If Professor Thiselton Dyer would kindly tell us what plants are most likely to attract ichneumons and other hymenoptera, he would be doing us a real service. Vine growers encourage the little

chalcis (chalcis minuta); cane growers may be equally wise, and do the same thing. I hope your scientific readers will tell us what kind of hymenoptera is the best to cultivate, and how we can best do so.

I am, Sir,

Your obedient servant,

W. BANCROFT ESPEUT.

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### MONTHLY LIST OF PATENTS.

Communicated by GEORGE DAVIES, C.E., Patent Agent, 4, St. Ann's Square, Manchester.

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#### ENGLISH.

##### APPLICATIONS.

2656. ROBERT BARTLETT, of the City of London, Engineer. *Improvements in the construction of sugar-cane mills.*

2829. FREDERICK BRADFORD MC.CREA, of Ealing, Middlesex, and EDWARD ALFRED COWPER, 6, Great George Street, Westminster. *Improvements in apparatus for chopping sugar into lumps.*

##### ABRIDGEMENTS.

4290-77. ABRAM LYLE, senior, of Greenock, Renfrew, Scotland. *Improvements in apparatus to be used in packing sugar or other granular or powdered material in casks or other holders.* This invention consists essentially of a platform for the cask or holder, which platform is caused to rise gradually and drop suddenly, by means of cams arranged beneath it. The cams are set in motion while the cask or holder is being filled, and the repeated lifting and dropping of the platform, with the cask or holder upon it, produces concussion in the sugar or other material, and causes it by its own weight to become compacted and densified more completely than when shaken by hand, and more completely than when ramming or compressing processes are employed.

4671-77. JOHN HENRY JOHNSON, of 47, Lincoln's Inn Fields, Middlesex. *Improvements in the production of saccharate of lime.* (A communication from Dr. Augustus Seyferth, of Brunswick, Germany.) In carrying out this invention, molasses (or other saccharine products) of low quality are taken and rapidly mixed with finely divided anhydrous caustic lime. This mixing is effected in a pug mill similar to that used in the manufacture of ordinary superphosphate, and during the said mixing little if any visible action takes place. The apparently fluid mass is then run into a receiving tank, when after the lapse of a few minutes a violent action commences, the lime being

slaked by the water of the molasses, and entering into combination with the sugar to form a saccharate of lime of a highly porous and friable character. This process is far more rapid and simple than those ordinarily employed, whilst the product obtained is suitable for processes for which the ordinary form of saccharate of lime cannot conveniently be used.

4672-77. JOHN HENRY JOHNSON, of 47, Lincoln's Inn Fields, Middlesex. *Improvements in the purification and treatment of saccharate of lime, and in the application of the products resulting therefrom.* (A communication from abroad by Dr. A. Seyferth, of Brunswick, Germany). To purify saccharate of lime by this process, the saccharate of lime in a solid form is broken up into moderately-sized fragments and placed in a vessel. It is preferable to use saccharate of lime produced by the process described in the specification of letters patent No. 4671-77. Alcohol, or a mixture of alcohol and water, or methyl alcohol, is then allowed to permeate the mass, and fresh alcohol is supplied from time to time, until nearly all the salts soluble therein and a large portion of the foreign organic matters have been removed. The purified saccharate of lime is then dissolved by the action of steam, and any alcohol it may contain collected by distillation. The alcohol which has served for the first washing of one portion of saccharate of lime is used to wash a fresh quantity, and so on, until it has become saturated with impurities, when it is submitted to distillation, and the original alcohol is thus recovered. In carrying out the second part of this invention, the saccharate of lime is dissolved in water or by the action of steam, and carbonic acid gas is passed through the solution until the lime is precipitated in the form of carbonate of lime, the sugar being set free. This solution of sugar is either concentrated to obtain a crop of sugar therefrom, or employed to dissolve a further portion of raw sugar for the ordinary operations of the refinery. This solution of sugar may also be used for brewing purposes, or for the manufacture of oxalic acid. The refuse left after distilling the alcohol may be employed as manure.

4682-77. HUNTER HENRY MURDOCH, of No. 7, Staple Inn, Middlesex. *Improvements in the manufacture and refining of sugar.* (A communication from Robert S. Kirkpatrick, of Brussels, Belgium.) The first part of the invention consists in the treatment of syrups or molasses from which part of the crystallizable sugar has already been extracted. Lime, preferably in the form of milk or cream of lime, is added to the syrup or molasses while cold, and this cold limed syrup or molasses is subjected to the action of a current of carbonic acid gas for a sufficiently long time to cause a distinct and well-defined gelatinization, but not long enough to decompose the gelatinous compound so formed. The limed and gassed syrup or molasses is then boiled for a short time, and filtered when as near the boiling point as possible; it is then regassed while still hot, (this current of gas being continued

long enough to convert all the lime which will combine with carbonic acid into carbonate of lime), and again filtered. This process of defecation is repeated as often as may be necessary upon each separate jet of syrup or molasses obtained. This invention consists further of a modification of the process of second gassing. Instead of treating the syrup or molasses under atmospheric pressure only, it is put in a closed vessel and heated above its ordinary boiling point, and is therein regassed, by forcing the carbonic acid gas in under excess of pressure, a safety-valve being provided to allow any excess of carbonic acid gas to escape. This gassing under excess of pressure causes a more perfect combination between the lime and the carbonic acid gas, and thus sets free the sugar which has been combined with the lime in the form of sucrate of lime, and decomposes the glucate of lime. This regassed juice, syrup, liquor, or molasses is then filtered (preferably while still under pressure), and the liquor may at this stage be passed through animal charcoal if necessary, and a very small quantity of this latter will be sufficient. Another part of this invention consists in dissolving low sugars in cane-juice instead of water; thus avoiding the addition of the water ordinarily used in refining, which has to be subsequently evaporated, and thereby diminishing the expense of refining low sugars.

## AUSTRIAN.

28. H. A. J. MANOURY, of Capelle (France). *Improvements in the process and apparatus for obtaining tribasic saccharate of lime, and treating the same with alcohol.*

## BELGIAN.

45238. A. L. G. DARNE. *Wooden filters and their application in filter presses.*

45285. C. SCHEIBLER. *A process and apparatus for extracting and determining sugar contained in vegetable substances.*

## SUGAR STATISTICS—GREAT BRITAIN.

To JULY 20TH, 1878 AND 1877. IN THOUSANDS OF TONS, TO  
THE NEAREST THOUSAND.

	STOCKS.		IMPORTS.		DELIVERIES.	
	1878.	1877.	1878.	1877.	1878.	1877.
London . . . .	80	91	153	177	168	138
Liverpool ..	39	35	119	123	110	105
Bristol . . . .	5	4	27	26	25	25
Clyde . . . . .	71	40	166	149	135	126
Total ..	195	170	465	475	438	394
Increase..	25		Decrease..	10	Increase..	44

STOCKS OF SUGAR IN THE CHIEF MARKETS OF THE WORLD ON THE  
1ST JUNE, FOR THREE YEARS, IN THOUSANDS OF  
TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
177	109	42	24	4	356	305	383

CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING  
1ST JUNE, IN THOUSANDS OF TONS.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
899	278	25	286	178	1666	1543	1651

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE,  
FOR THE ENSUING SEASON, COMPARED WITH THAT OF THE THREE  
PREVIOUS SEASONS.

(From *Licht's Monthly Circular*.)

	1877-78.	1876-77.	1875-76.	1874-75.
	Tons.	Tons.	Tons.	Tons.
France .....	365,000	243,295	462,259	450,877
Germany (Zollverein) ..	370,000	291,204	346,646	250,708
Austro-Hungary ....	330,000	247,175	208,912	158,884
Russia and Poland ..	220,000	250,000	245,000	222,500
Belgium .....	65,000	44,467	79,796	71,079
Holland and other Countries.....	25,000	25,000	30,000	30,000
Total.....	1,395,000	1,101,141	1,372,613	1,184,048

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STATE AND PROSPECTS OF THE SUGAR MARKET.

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The Sugar Market has been quiet and steady during the past month, quotations closing a shade cheaper than at the beginning of the month. The firmness of holders checked business towards the end of the month, refiners not being able to advance on current prices for raw, a slight advance, however, being then reported for raw in Liverpool.

The excess of stocks of sugar, as compared with 1877, has increased from about 19,300 tons on the 22nd June last to about 24,500 tons on the 20th July, the imports having been in excess of the deliveries.

We do not see reason for expecting much change in the market during the coming month. 88 per cent. beet, for October and November delivery, is quoted about 1s. 9d. per cwt. below present prices.

Present quotations of the standard qualities are as under:—  
Porto-Rico fair to good refining, 21s. to 22s., against 21s. to 22s.; good to fine grocery, 23s. to 25s., against 23s. 6d. to 25s. 6d.; Martinique crystals, 27s. to 27. 6d., against 27s. to 27s. 6d.; No. 12 Havana, 23s. to 23s. 6d., against 23s. to 23s. 6d.; fair to good refining Cuba Muscovados, 21s. to 21s. 6d., against 21s. to 21s. 6d.; middling to good brown Bahia, 18s. 6d. to 19s., against 19s. to 19s. 6d.; good to fine Pernambuco, 19s. to 20s. against 19s. 6d. to 20s. 6d.; Paris loaves, 28s. 3d. to 29s. against 28s. 3d. to 29s.

# THE SUGAR CANE.


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No. 110.

SEPTEMBER 2, 1878.

VOL. X.

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 The writers alone are responsible for their statements.

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## PROFESSOR FAWCETT ON THE SUGAR BOUNTIES.

We gave, in our July number, an abstract of Mr. Fawcett's remarks in reference to bounties on exports, in his recently published work 'on Free Trade and Protection,' and an extract of the whole paragraph which dealt with the question of the foreign sugar bounties as they affect this country. The following letter (*Daily News*, of August 10,) from the Secretary to the Sugar Refiners' Committee, embodies an examination of Prof. Fawcett's arguments in a reply to the *Daily News*' critique of that portion of the book:—

“In your interesting notice of Professor Fawcett's book, ‘Free Trade and Protection,’ you say that he criticises most thoroughly and exhaustively the arguments for imposing import duties on articles whose export from foreign countries is favoured by means of bounties. As representing a very important branch of the sugar trade of this country, I have always been anxious that this question should be thoroughly sifted by competent authorities; and, being a free trader, I have been particularly anxious to obtain from Mr. Fawcett a careful consideration of the matter. I hope, therefore, that you will kindly permit me to state, in reply to this and other statements in your valuable review of his work, why I am led to the conclusion, with much disappointment, that Professor Fawcett has not only omitted to examine the arguments advanced in favour of countervailing export bounties by means of import duties, but that he has given very poor reasons against such a



course. It would be very presumptuous to make this statement were it not that the force of circumstances and my official position in connection with my trade have compelled me to examine everything that has been said and written on this question, and thus accidentally qualified me as a critic.

“The arguments which have been accumulated from time to time against the theory that foreign export bounties are an unmixed benefit to this country, and in favour of some measure for counter-acting their evil effects, may be put in a small compass. A correspondent in a contemporary, a few days ago, expressed in the following concise and graphic terms the evil effects of the sugar bounties. These effects are, he said, ‘to transfer a source of supply from the natural, the certain, and the cheaper, to the artificial, the precarious, and the dearer zone of cultivation, with competition proceeding at a higher level of cost of production, thus transferring to the consumer of to-morrow the burden of the protection which, bribe-like, advantages the consumer of to-day; to shift competition and market values from that adjustment, ever beneficial to consumers, which results from competing relative natural advantages; to lower prices below their natural level by a State subsidy to one set of competitors, thus compelling its equivalent from, or the withdrawal of, all other competitors; to check tropical cultivation and divert English capital and labour there and at home from a natural sphere of industry.’ Lord Derby, Lord Aberdare, and other public men, have pointed out that the results of a bounty-fed competition must be decreased production, and therefore increased cost to the consumer. Sir Michael Hicks-Beach, in reply to a recent deputation of planters and merchants, said that in the face of this fact it would be a short-sighted policy for the consumer to desire a continuance of the bounty. The Chancellor of the Exchequer only a few days ago emphatically endorsed these views. The arguments are quite good enough in themselves, but I mention these opinions of men who cannot be accused of any leaning towards the fallacies of protection in confirmation of them. The effect of the bounty being admitted to be injurious, it should either be neutralised or the bounty removed. Negotiation having failed to obtain the latter, the question remains

how to accomplish the former. It has been shown that a duty equivalent to the bounty would either, as is most probable, stop this bounty system at once—in which case it would be immediately removed,—or it would restore competition to its natural level, and in doing so would still secure the benefit of the bounty, only that it would go towards a relief of taxation, instead of benefiting those only who consume sugar.

“These being the arguments of those who maintain that foreign export bounties are a natural injury to this country, and ought, therefore, to be stopped or neutralised, I look in vain in Mr. Fawcett's book for the faintest reference to them. His remarks on the sugar bounty, in its relation to this country, are confined to page 27 and half of page 26.\* In these he simply states that, in his opinion, ‘we should be the last to complain if the French are willing thus to tax themselves for our benefit.’ ‘England gains, as certainly as France loses, by the bounty on French sugar; and as long as France is willing to tax herself for our benefit, why should we refuse to accept the advantage which is offered to us?’ If I am right in believing that these are the only passages which refer to the effect of the bounty on this country, I think I am not exaggerating if I say, with regret, that Mr. Fawcett has entirely ignored every argument by which we have sought to show that the bounties are a national injury, and not a national benefit—arguments which have been endorsed by those whose opinions cannot be lightly passed over.

“Denying the existence of a national injury or evil, and ignoring the arguments by which that denial had already been met, Professor Fawcett has the less difficulty in condemning a remedy the necessity for which he overlooks. But even here he appears to have no strong case, for he bases his opposition to a countervailing duty on the ground that ‘we should soon find ourselves involved in a labyrinth of commercial restrictions, and our tariff would become as protectionist as is the tariff of the most protectionist country.’ If Mr. Fawcett had commenced by examining the arguments which aim at showing that the foreign bounties

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\* *Sugar Cane*, July, 1878, page 338.

infract a national injury, he would only be justified in making this statement after showing those arguments to be erroneous; for a measure which should avert a national injury could not be placed in the same category with commercial restrictions or protectionist tariffs. Professor Fawcett goes on to illustrate his meaning by saying that Belgian iron and American cotton goods are sometimes imported into England, though our manufacturers cannot export a single ton of iron to Belgium, or a single bale of cotton goods to the United States, without the payment of import duties. 'If, therefore,' he concludes, 'English sugar refiners were protected against the competition of cheap French sugar, English ironmasters and English cotton manufacturers would be able to put forward an unanswerable claim to be secured against the competition of their foreign rivals.' This is the sum total of Mr. Fawcett's 'thorough and exhaustive criticism' of this subject. Having ignored every argument in disproof of his dogma that 'England gains as certainly as France loses by the bounty on French sugar,' he proceeds to prove that any steps to counteract the effects of the bounty would 'involve us in a labyrinth of commercial restrictions,' by citing a case which is not only entirely different from, but in many respects the exact converse of, a bounty-fed competition. If iron and cotton goods can be made cheaper here than in Belgium and America, owing to our possessing greater natural advantages, we need not fear Belgian and American competition, either in our own or foreign markets. If Belgium or America are foolish enough to shut out our products from their own markets, that can give us no good reason for doing the same; an act which would, moreover, be without effect in the supposed case of this country possessing superior productive advantages. If, on the other hand, the natural advantages should be on the side of Belgium and the United States, a demand for an import duty would be equivalent to asking that the British consumer should be prevented from reaping the full benefit of those advantages. But in the case of the sugar bounties it is exactly because they tend to check natural production, such as that in our West India Islands and elsewhere, and to deprive the consumer of the permanent advantages which are alone to be derived from

natural sources, compelling him to have recourse to an artificial and therefore precarious supply, that a means of neutralising them is demanded in the interests of the consumer no less than of the producer. The Chancellor of the Exchequer, in his remarks the other day, referred to this confusion of two essentially different cases. 'We ought not,' he said, 'by any legislative enactment, to interfere to prevent other countries making use of their natural advantages to supply us with the products which they could supply more advantageously than we could. But that principle did not apply to a case in which, by legislative action on the part of a foreign Government, by any artificial action on their part, they could supply us with an article which, if things were left to their natural courses, we could supply as cheaply, or more cheaply, ourselves.' The only illustration given by Mr. Fawcett in support of his only objection to resisting bounty-fed competition appears, therefore, to fall to the ground.

"You say that 'Mr. Fawcett makes an argument for doing nothing which helps to meet the agitation that has lately been renewed, but which, curiously enough, we may remark, was little heard of rather more than a year ago when the sugar trade was prosperous, although French bounties were as heavy then as now.' I am sure that your well-known sense of fairness in desiring that all sides of a question should be thoroughly examined, will lead you to admit that this letter is not uncalled for in reply to that statement, and I therefore trust that you will give it a place in your valuable and I fear, at the present moment, overburdened columns. It is a mistake to suppose that this agitation was not as active a year ago as it is now. A most important Conference was being held in Paris rather more than a year ago, lasting over five weeks, at which it was hoped that a final settlement of this vexed question had been come to; and it is owing to the extraordinary conduct of the Dutch Government in repudiating its former acts and declarations, that negotiations which promised to be effectual have proved abortive. Hence the agitation has been transferred from diplomacy to the platform, from international conferences to deputations, and from official despatches to the public Press. It is also rather more than a year ago that the failure of one of the

largest sugar refining firms in this country took place, and the country for the moment rang with the outcry against the bounty-fed competition to which we are exposed. A reference to the newspapers of April, 1877, both daily and weekly, London and provincial, will show that the matter was discussed with considerable warmth and interest.”\*

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### THE BRISTOL CHAMBER OF COMMERCE AND THE SUGAR BOUNTIES QUESTION.

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In pursuance of the resolution passed by the Council of the Bristol Chamber of Commerce on the sugar bounties question, on the 21st of June, the following memorial has been sent to the proper Government departments, mentioned in the resolution, and a copy to Mr. Morley, M.P.:—

*“The humble Memorial of the Council of the Bristol Incorporated  
Chamber of Commerce and Shipping*

*“Sheweth—*

“That your memorialists have watched, with considerable attention, the negotiations which have been carried on by Her Majesty’s Government with the foreign Governments, parties to the Convention of 1864, which was entered into for the purpose of insuring the fair and equitable assessment of duties on sugars as between the respective nations, and have observed with much regret that the repeated attempts of Her Majesty’s Government, continued from time to time for the last four or more years, to obtain new arrangements which would place this country on an equal footing with those foreign countries, have ended in complete failure, owing to the persistence of those Governments in a system of levying the duties in such a manner as to give considerable bounties on the exportation of sugars from those countries to this.

“Your memorialists deem it unnecessary to enter into details with regard to this question, as they are well known to Her Majesty’s Government. They would, however, venture to direct

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\* *Sugar Cane*, May, 1877, pages 220 to 234.

your attention as strongly as they can to the great injustice and injury which have thus been imposed on the producers in our colonies and foreign possessions, and to the ruinous effects on the home manufacturers of refined sugars, and the distress thereby occasioned to the working classes connected with the trade.

"Your memorialists beg leave respectfully to inform you that the question has been recently discussed at a full meeting of the Council of this Chamber, when the following resolution was passed, to which your memorialists humbly pray Her Majesty's Government will be pleased to give their attention and favourable consideration:—

"That this Council is of opinion that immediate action should be taken by the Government to enable the sugar refiners of this country to compete fairly with those of other countries; and as the great bar to this is the foreign system of allowing a bounty on manufactured sugar exported to this country, that a duty should, after the expiration of a certain defined notice, be levied on foreign manufactured sugar equivalent to the bounty allowed; and that a memorial to this effect be laid before the Foreign Office, the Colonial Office, the Board of Trade, and the Right Honourable the Chancellor of the Exchequer.'

"Signed and sealed in pursuance of a resolution of the Council passed the 21st day of June, 1878.

"GEORGE DE LISLE BUSH, President.

"HENRY T. CHAMBERLAIN, } Vice-Presidents.

"WILLIAM M. GIBSON, }

"LEONARD BRUTON, Secretary."

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The ordinary monthly meeting of the council of this Chamber was held on Friday, the 19th of July.

The President read the following letter from the Colonial Office, acknowledging the receipt of the Chamber's memorial:—

"Colonial Office, Downing Street, 8th, July 1878.

"Sir,—I am directed by the Secretary of State to acknowledge the receipt of your letter of the 25th ult., enclosing a memorial on

the sugar bounty question addressed to Sir Michael Hicks-Beach by the council of the Bristol Incorporated Chamber of Commerce and Shipping. I am to acquaint you, in reply, that the matter is engaging the attention of Her Majesty's Government, and that a further letter will be addressed to you in due course.—I am, &c.

“R. H. MEADE.

“To the Secretary, Bristol Incorporated Chamber of Commerce.”

Letters were also read from the Foreign Office, the Board of Trade, and the Chancellor of the Exchequer, to whom also the memorial had been addressed, as well as to Mr. Morley, M.P., who wrote in reply as follows :—

“18, Wood Street, London, E.C., 8th July, 1878.

“Dear Sir,—Continued pressure of engagements has prevented my acknowledging receipt of the memorial in reference to the sugar duties. You will have seen what has taken place in London on the subject, which was in accordance with the spirit of the memorial. I have no doubt whatever that the system of bounties is a disgraceful departure from the principles of Free Trade.

“Yours faithfully,

“S. MORLEY.

“G. De Lisle Bush, Esq.”

The following letter from the secretary to the British Sugar Refiners' Committee was also read; and a resolution was passed requesting the local newspaper proprietors to publish it with the report of the proceedings of the council :—

“21, Mincing Lane, 12th July, 1878.

“L. BRUTON, Esq., Secretary Bristol Chamber of Commerce.

“Dear Sir,—I am sorry that absence from home has prevented me from thanking you earlier for the newspaper cutting you kindly sent me on the 3rd inst., giving an account of a recent meeting of your Chamber of Commerce, which I have just read with much interest.

“Mr. Lewis Waterman, in his letter to your President, falls, I venture to think, into some errors in the reasons he advances against the resolution which you afterwards carried. A counter-vailing duty would not be a tax on the consumer. Under existing

circumstances he receives a present from the French Government, and an equivalent present from all other sugar producers. The latter he has no right to at all. The former he has no right to as a consumer of sugar, though he may fairly maintain that a present made by the French Government to this country should not be rejected. A countervailing duty would restore the price of sugar to its normal and natural condition; it would deprive the consumer of the present which, so long as the bounty operated, all other producers were unjustly compelled to give him; and it would secure to the nation at large the present given by the French Government, which had previously been enjoyed only by the consumer of sugar. A duty to countervail a bounty has nothing to do with reciprocity. It is simply securing the bounty in relief of taxation. For the same reason it is not a retaliatory duty. It neutralises the bad effects of the bounty without foregoing the gain to the country of a present made to it. Those who say that we ought not to admit those products which are naturally most cheaply produced abroad, unless foreign countries will admit what is most cheaply produced here, are the advocates of reciprocity and retaliation. They propose that because foreign governments prevent their consumers from getting commodities at their natural value, we should do the same—a proposal evidently unsound and mischievous. We propose, on the contrary, that a present made to us by a foreign Government should be enjoyed by the whole nation, and injure no one; instead of being, as now, enjoyed only by the consumer of one particular article, to the injury of all other producers of that article, and therefore to the ultimate reduction in the supply of the article and consequent injury to the consumer himself. A countervailing duty would, therefore, be the only way of securing, as regards the sugar bounty, Mr. Waterman's principle of the greatest good to the greatest number. Mr. Cobden said that it mattered not whether free trade made an article cheaper or dearer, so long as it secured its supply at its natural value. It is evident from what I have said that a countervailing duty will not, as Mr. Waterman thinks, make the many suffer for the few, nor tax the community to give an artificial support to a small number of pro-



ducers. On the contrary, it relieves the community of taxation to the amount of the bounty, and relieves all natural producers from an artificial competition which is now compelling them to make a present to the consumer equivalent to that made by their bounty-fed competitors.

“To Mr. Cashmore’s remarks I would reply that the croaking at the time of the repeal of the Corn Laws would not be a parallel case to ours unless a bounty were given on the export of foreign corn; in which case our farmers would have been compelled to cease growing corn altogether. Mr. Cashmore forgets that the existence and extent of the French bounty has been fully admitted by French Commissions of Inquiry, and by the responsible Ministers of the French Government, who have repeatedly promised our Government that it shall be stopped. Hitherto they have failed to do so, and it is well known that this is owing to the powerful influence of the French refiners, who are the richest men in Paris.

“Mr. Lane is quite content to let the future take care of itself even though the effects of the bounty may be to stop all natural production. As soon as money was to be made he thinks the refiners would start again. This is what Sir Michael Hicks-Beach called “a short-sighted policy.” Mr. Lane forgets that stopping the natural production means a great deal more than merely stopping the British refineries. It means more than halving the present supply of sugar, and therefore more than doubling its cost.—I am, &c.”

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#### THE DUTCH GOVERNMENT AND THE SUGAR CONVENTION.

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The following letter from the Secretary of the British Sugar Refiners’ Committee appeared in the *Daily News* of August 2nd. A similar letter was published in the *Times* of July 30th:—

Sir,—Mr. Bourke is reported to have stated on Thursday night, in reply to a question from Mr. J. Stewart, that the negotiations which have been going on for a long time with reference to the abolition of bounties on the exportation of refined sugar from France and Holland are at present suspended in consequence of the

refusal of the Dutch Government to adopt the system of refining in bond. This is so extraordinary a proceeding on the part of the Dutch Government, and so completely upsets all that has been accomplished in the laborious and hitherto successful negotiations of the last six years, that I am desired by my committee to request the favor of a small space in your columns in order to point out the very false position in which the Dutch Government has placed itself. A reference to the minutes of the Conferences held in Paris last year and the year before will show that the representatives of that Government were most emphatic and persistent in insisting that refining in bond is the only satisfactory method of abolishing the export bounties and the only acceptable basis of a treaty. It was through their efforts that the alternative scheme proposed by France in 1876 was rejected, and that a Convention based on refining in bond was accepted at the Conferences of the following year. The scheme for carrying out refining in bond, as stated in the draft of that convention, was actually drawn up by the Dutch delegates themselves. So anxious was the Second Chamber of the States-General that a convention on that basis should be entered into, that it passed a resolution, in April, 1876, desiring the Dutch Government to resume negotiations on the basis of the Treaty of 1875 (refining in bond), which had been ratified by the French Assembly, but had, unfortunately, been thrown out by the Dutch Chamber through a misunderstanding as to the power of that country to abolish its sugar duties. It may be said that a new Government has come into power since the Conferences of last year. A reference to the debate which took place in the Dutch Chamber on the resolution to which I have referred will, however, show that the present Prime Minister of Holland supported that resolution with some emphasis, and added the following words:—"It is important to do away with every notion among foreign Powers that our object is to maintain Protection. The motion will be an aid to the Government in their maintaining free-trade principles in carrying on fresh negotiations." In the face of these facts, the sudden refusal of Holland to accept the system of which she has been recently the chief champion, and the provisions for which she has herself drawn up, appears to be a little too unreasonable to be

accepted without procuring from the Dutch Government a frank avowal that they are compelled to depart from the policy they have hitherto pursued throughout the negotiations, and now find it absolutely necessary to maintain the existing subsidy to their refiners. That such a bounty exists in Holland is not disputed; for it has been officially admitted to amount to 1,800,000 florins per annum, which is more than 30 per cent. of the revenue from sugar. At the time that this admission was made it was stated that sugar refining is the only industry in Holland which receives such protection; that no one had yet defined what were the alleged difficulties in the way of Excise supervision, and that the Government were ready to meet any definite objections; and that the Convention then before the Chamber (that of 1875) "would remove both Dutch and French protection, and put a stop to a system by which money is sacrificed in order to give sugar cheaper to the rest of the world." Holland has, therefore, officially admitted that she is sacrificing a considerable portion of her revenue in protecting her sugar refiners; that theirs is the only industry in the country which now receives such protection; that the Convention drawn up by her own delegates, in obedience to a resolution of her Chambers, would remove this protection, and at the same time relieve her refiners of a similar subsidised competition in France. And yet, in spite of all this, and of a declaration by the present Prime Minister of the Netherlands that foreign Powers ought not to be allowed to imagine that Holland desires to maintain this protection, his Government has been driven, by the influence of those interested in the protected industry, to repudiate a treaty which owed its existence to the initiative of Holland, and its details to the pertinacity of the Dutch delegates. Surely our Government, after the great care and trouble they have devoted to these negotiations, will not permit matters to remain in this position without insisting on a clear statement from Holland of the real meaning of conduct which would certainly not be tolerated among individuals without a satisfactory explanation.—I am, &c.

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THE FOREIGN SUGAR BOUNTIES.

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A special meeting of the Central Executive Committee of the National Operative Sugar Refiners, Coopers, Dock Labourers, and Warehousemen's Societies was held at the Albion Hotel, Blackfriars road, Mr. George Jones, secretary to the London Coopers' Society, in the chair. There were delegates present from Manchester, Liverpool, Greenock, Dublin, Plymouth, Leeds, and other towns. Mr. S. Peters, the general secretary, reported that the movement in favour of abolishing the sugar bounty system was making remarkable progress. During the past week several members of Parliament had given in their adhesion to the principle of the imposition of a countervailing duty. It was felt that the time had come to speak out; and he appealed to his brother delegates from the provinces, and from Scotland, and from Ireland to go back to their respective towns and make the question of the countervailing duty one of the planks of the working men's political programme at the approaching general election.—The Chairman, as a free-trader of thirty-years' standing, asserted that the imposition of a temporary countervailing duty was the only practical solution of the difficulty.—Mr. Richard Hunt, president of the West of England Coopers' Society, maintained that if free trade annihilated the true sources of natural production, so as to bolster up an artificial industry like the beetroot sugar trade of the continent, it was undoubtedly time to improve the practical working of free-trade principles. Mr. Kelly, assistant-secretary of the Dock Labourers of England Society, moved: "That in the opinion of this meeting the working classes would be more largely benefited by obtaining an outlet for their labour than by remaining in a state of semi-starvation through the operation of one-sided free trade." He said that to them it was not a matter of false economic doctrine, but simply one of bread and cheese. When they were thrown out of employment through no fault of their own, it was time that they, as a body, should raise their voices against a system which was a crying evil. Mr. Monteith, president of the Philanthropic Society of Coopers, seconded the motion, which was carried.

### BRISTOL COOPERS AND THE SUGAR BOUNTIES.

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A general meeting of the Friends of Humanity Society of Coopers was held on Friday evening, July 29th, 1878, at the Clubhouse, Cat and Wheel, Castle Green, for the purpose of considering the injurious effects to the trade of the operation of the foreign sugar bounties.

Mr. RICHARD HUNT, president of the society, occupied the chair, and in opening the proceedings referred at great length to the evil results accruing to the coopers throughout the country in consequence of the decline of the West Indian trade through the sugar bounty system in France. He stated that in consequence of the failure of the sugar refining industries of Bristol 125 journey-men coopers were thrown out of permanent employment, and this lamentable state of things represented only in a limited degree the condition of things existing at that moment at the whole of the sugar refining centres of the kingdom. During the past eighteen months the Bristol Society alone had expended from its funds upwards of £1000 to assist their fellow shopmates who were thrown out of work through no fault of their own. This could only be attributed to one cause, namely, the evil and immoral operation of the sugar bounties. (Applause.) Whilst their West Indian trade was in a state of langour, the foreigners' beetroot sugar trade was largely on the increase, and he for one predicted that if the present state of things went on much longer the West Indian trade would become in all probability a thing of the past. (Cheers.) It was their bounden duty to use every effort in their power to preserve this industry, and this could only be done by the abolition of the odious and one-sided system of bounties. They had striven by conventions, by negotiations, and by all honest means to make the foreigners act honestly towards them in the matter of the bounties, but up to the present time they had failed in their efforts to induce foreign Powers to remove the drawbacks upon sugar. (Hear, hear.) It was now their duty to place a temporary countervailing duty upon Continental beet sugars entering the ports of the United Kingdom, such duty to be

removed directly the bounties were abolished by foreign Governments. (Loud applause.) In advocating this course they, as a nation of free traders, were not departing from the true principles of free trade. (Hear, hear.) They were most anxious to bring into operation the principles of universal free trade, but the foreigners would never become free traders in sugar until the voice of the English nation—as expressed through their working class organisations—forced them to do so. As Mr. Morley, M.P., had said, this temporary countervailing duty was an absolute necessity for the legitimate preservation of the refining industries of the country, and all branches of labour dependent upon the sugar trade of Great Britain. (Loud cheers.)

Mr. ALEXANDER MONTGOMERY, the secretary of the society, moved, and Mr. COOMBS seconded, the following resolution:—

“That in the opinion of this meeting the doctrines of free trade require that all competition should proceed upon the basis of relative natural advantages, thereby securing to consumers the lowest natural price approximating to the lowest natural cost of production. But the bounties given or obtained on exports of raw beet or refined sugar to this country from France, Holland, Belgium, Austria, Germany, and Russia operate upon the English sugar market so as to prevent competition on the free trade basis of natural advantages, and thereby deprive English producers of their right to free trade competition in their own markets, inflicting upon them the necessity of withdrawing from the unjust competition, or of giving out of their own profits and wages the equivalent of the foreign bounty.”

Mr. DAVIS moved, and Mr. H. PAGE seconded, the second resolution, which was as follows:—

“That diplomacy and treaty engagements having failed to stop these export bounties, it is the opinion of this meeting that it would be quite consistent with every principle of free trade to restore free trade competition to the English market, and to intercept for the revenue the foreign bounties, by levying against all raw and refined sugar exported to this country under such bounties a duty equivalent to the same. Provided that such duty be at once

taken off as against any country abolishing bounties to the satisfaction of her Majesty's Government."

Mr. S. PETERS, general secretary of the National Operative Sugar Refiners, heartily supported the second resolution. He maintained that it would be quite in accordance with the first principles of free trade to place a temporary countervailing duty upon all bonus sugars coming into this country. (Hear, hear.) The system of which they complained had thrown thousands of honest English operatives out of permanent employment, and it was necessary that the odious system complained of should be met with a firm hand. (Cheers.) He was glad to be able to state that meetings were in course of organisation all over the country to advocate this course, and already their Central Executive were taking active measures to bring the whole question prominently before the attention of Parliament.

Mr. CHARLES FOX and others also spoke.

The resolutions, which were adopted unanimously, were ordered to be sent to Mr. Morley, M.P., Mr. Gladstone, M.P., and the Chancellor of the Exchequer, and the meeting terminated with hearty votes of thanks to the chairman.

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## THE SUGAR BOUNTIES QUESTION.

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### PUBLIC MEETING IN GREENOCK.

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The second of a series of public meetings of operatives in the sugar trade, to be held in the sugar refining districts of England and Scotland, for the purpose of protesting against the bounty system carried on by France, Holland, and other countries, took place in the Town Hall, Greenock, on Saturday evening. Notwithstanding the good weather and other attractions, there was a large attendance of working men. Mr. Stewart, M.P., for Greenock, occupied the chair, and was supported by a large number of working men forming the local committee appointed to take action with regard to the bounty question. Amongst those on the platform were Mr.

Samuel Peters, secretary to the Bristol Sugar Operatives' Society; Mr. Thomas Kelly, secretary to the London Society; Mr. Donald M'Donald, sugar broker, Greenock; Mr. Malcolm M'C. Brown, Mr. Sinclair, of Messrs. Richardson, Greenock; Mr. Patterson, chemist; Mr. William Young, president of the Greenock Coopers' Society; Mr. James Wilson, secretary to Greenock Sugar Porters' Society; Mr. Alexander M'Dougall, secretary of Glasgow Coopers' Society; Mr. James Barr, Glasgow, ex-secretary Glasgow Coopers' Society; Messrs. Murray and Henderson, delegates from Glasgow; Messrs. Henry Hill, stevedore; John M'Kellar, cooper; William Brand, David M'Coll, cooper; John Paton, cooper; Neil Innes, rope spinner; John Weir, cooper; John Blair, cooper; Robert Scott, cooper, &c., &c.

The Chairman, who on rising was loudly cheered, said: Gentlemen, I need not say that it gives me great gratification to have been asked to preside here this evening at a meeting of working men. I cannot but be aware that but for the confidence which a large portion, at least, of the working men of Greenock placed in me I would not now be in the honourable position of Member for Greenock. (Applause.) When, therefore, I was asked by your committee of management to preside here this evening I had very little hesitation in acceding to that request, but I was obliged to put a certain reservation upon my promise, and that was that I was not perfectly sure how far my own sentiment in regard to this question might go in unison with the society which has brought this meeting together. I feel therefore all the more gratified on taking the chair this evening inasmuch as you have taken me with that reservation. I feel that the motto which you have put over your bills—"free trade and fairplay"—is one that commends itself to all the best feelings of British men. (Applause.) We are most of us in Greenock hearty free-traders, and I may say that if this meeting had been brought together merely with a view to upset in any degree the principles upon which free trade is founded, I at least would not have been here to support it. (Applause.) But, gentlemen, the position of the industry we are here met to consider is one of peculiar hardship, and it is one in which the principles of free trade are not allowed to work in a fair and



legitimate manner. (Hear, hear, and applause.) I ought to have said, in mentioning the circumstances which led me to take the chair this evening, that it occurred to me that your worthy Provost might have been the more appropriate person to preside on this occasion; but when I considered that he is a sugar refiner himself, and reflected that I am not, and therefore could not be subject to the remark that I was promoting any private interest, I felt that it was fitting that perhaps on these accounts I should be in the chair. (Applause.) Well, gentlemen, I have said that we do not think that British refining interests get fair play. I need not tell you that that is brought about on account of foreign governments putting on a bounty which enables them to undersell our manufacturers in the British market. Now it is useless to conceal from ourselves that in attempting to set this matter right there are great difficulties and intricate questions which arise, and I have great sympathy with the Government in respect to the difficulty they seem to feel in regard to what course should now be taken. We all feel, we must all admit, that this is a grievance of a very distinct kind which ought, if possible, to be set right, and yet we feel it ought to be set right in such a way if possible as not to infringe the great principles of Free Trade which we as a nation have adopted. (Applause.) I cannot believe that a great nation like France would be guilty of carrying on the present selfish system, a selfish system only as respects one or two classes in France—I mean that that system benefits the landowners and sugar refiners of France only, and does not at all benefit the great mass of the people. On the contrary, it puts a tax on the working classes of France. While, therefore, we in this country are attempting to promote our own interests in regard to this question, it is some encouragement to us to feel that if we succeed in forcing our views on the French Government and moving them to adopt a different line of policy we shall by that means be benefiting the labouring classes of France. (Applause.) Now I said a little ago—If I did not say so I say it now—that the effect of French refined sugar coming into this country is no doubt to keep down the price to the British consumer. But I wish to correct a fallacy into which I fell when I had the pleasure of addressing

a meeting of workmen in London a few weeks ago. I say I wish to correct a fallacy into which I fell when I said that it was a benefit to a very considerable amount which was conferred on the British consumer by the present condition of things. I see perfectly clearly that I fell into an error in saying that, because it is only necessary for the French exporter of refined sugar to sell his sugar 1½d. per cwt. below the natural price of the British refiner in order to ensure to himself a sale of his article as opposed to the British refiner. (Applause.) You see, therefore, it is a very small advantage indeed that the British consumer would receive from this import of French refined sugar, and in considering this question as a whole we must not forget this. At a meeting in London I ran away with the idea which is pretty prevalent throughout the country, that the advantage derived by the consumer throughout Great Britain is very considerable. That is an entire fallacy. Then I want to know, even if there was some considerable advantage derived by the British consumer, whether he would be altogether wise to avail himself of that advantage without one single thought as to the future. In the first place, supposing that the French sugar refiner is enabled by this bounty system to absolutely extinguish refining as a British industry, where would this country be, and what would foreign countries immediately do when they found the whole of that industry in their own hands? Is it at all likely that they would go on taxing their artizan class in order that the British consumer might be benefited thereby? Most likely they would lighten their taxation—they would be justified in doing so—and they would put an export duty instead of a bounty upon their refined sugar. (Hear, hear.) Now, I said a little while ago that your committee were kind enough to take me as your chairman this evening with a certain reservation. At the same time, the more I think on the question the more I feel that I can go to a very considerable extent along with them in the views they hold. (Loud applause.) The main question for us to consider undoubtedly is, what practical measures we can adopt in order to put an end to this wrong and grievous action of the foreign Governments. (Hear, hear, and applause.) I think—and I speak as a free trader, and

I am sure you will all sympathise with me in this—I think that the only satisfactory way—I have said satisfactory, mind you—the only satisfactory way in which we can deal with this matter is by negotiation, and by insisting in every possible way through our Government that the Continental Governments refine in bond, and thereby get rid of this system of bounties. (Applause.) This is unquestionably the way in which every free trader would like to see the matter settled. (Applause.) I would not despair that it may yet be brought about; at the same time, there is no question that the negotiations have been long and protracted, and we must not allow any great length of time to elapse if that means of righting this matter fail. (Applause.) The other way in which undoubtedly we could meet the evil is by a countervailing duty. (Loud applause.) Now, I am very chary in committing myself out and out to that way of dealing with the question. At the same time, I think that your action in originating meetings throughout the country in order to direct public attention to the position of this industry, and also with a view of educating the public mind in regard to this question, is in the greatest degree desirable, and ought in every way to be encouraged. In considering the question of a countervailing duty, there are one or two facts which it is desirable to bring before the public. Supposing that, unhappily, we find that is the only way in which we can deal with these foreign Governments, the effect of putting on a countervailing duty—supposing we put on such a one as in the main would represent the bounty given by these Governments—would not, I think, be to raise the natural price of the article, but would be to keep it at its proper price. (Applause.) I am subject to correction in this matter, but it seems to me that if an article produced in France has a bounty placed upon it, and comes over to this country to be resold, that if it enables the seller to reduce the price of his article below the natural price, and that the bounty is the amount which is represented thereby, then I think the putting on of the countervailing duty on this side would not raise the price of the article beyond its legitimate and natural price. (Cheers.) The main principle upon which free trade is founded is that the natural price of the article—without any fiscal addition tending to

enhance its price—is that at which it should be offered to the world at large. That is the grand ruling notion upon which free trade is founded, and it is that which Great Britain has sought to show a high example to the world. (Applause.) I hope that there will be no necessity for actually putting on this countervailing duty; but at the same time it is a weapon we have in our hands if all other things fail. (Applause.) Now, I do not like to refer to my own humble exertions in regard to this matter—(applause)—but perhaps it is right that I should say that, feeling it was extremely desirable, in the prospect of Parliament rising, that we who are interested in this industry should know what the position of the question really was, I brought it before the House of Commons—(applause)—about three weeks ago, in order to be quite sure, if I could, that the Government were not relaxing their efforts; and, in spite of the unfavourable reply received lately from the Dutch Government on the question, whether or not we were still determined to pursue the matter in the hope of obtaining a favourable result. I regret the reply which I got on that occasion was not encouraging, and, indeed, I was given to understand that the British Government had ceased to take action in the matter. Of course, gentlemen, I take no credit to myself as representative of Greenock, in which this industry is so largely carried on, for having taken action in the matter; but I felt that it was not satisfactory that the question should remain as it was, and, therefore, I considered what other action I should take in regard to it. I consulted with some of those interested in this cause, and we resolved that it would not be advisable to bring the matter once more before the House, inasmuch as sometimes more harm is done than good by making any question a bore in that high assembly. I, however, sought to obtain an interview with the Chancellor of the Exchequer the day before yesterday, and I am bound to acknowledge the courtesy and frankness with which he received my representations. (Applause.) I am bound, however, to say that any reply I could get from him was not of a very satisfactory kind. I feel perfectly confident that he is as much desirous as any of us are to bring about the result we desire, but he told me that there were difficulties in the matter, which at the moment he could not

see his way to remove. At the same time, the right hon. gentleman assured me that the very first opening the Government could possibly make they would endeavour to use in the direction we desire. (Applause.) Now I think, gentlemen, considering the reticence which is always necessary for a man like the Chancellor of the Exchequer to maintain, we should not expect him to say more than that. I feel confident that we shall have in this matter the sympathy of the whole nation with us, because while we are not all engaged in sugar refining, nor all profiting by that industry, we nevertheless are united in our desire to see the great industries of our country getting fair play, and I am quite sure this association has only to go on stirring up the various constituencies in the country, so that the people may clearly understand the position of this great industry, and the jeopardy it is in, in order that their efforts may be crowned with satisfactory results. (Loud applause.)

Mr. M'KELLAR, cooper, moved, "That in the opinion of this meeting the doctrines of free trade require that all competition should proceed upon the basis of relative natural advantages, thereby securing to consumers the lowest natural price approximating to the lowest natural cost of production. But the bounties given or obtained on exports of raw beet or refined sugar to this country from France, Holland, Belgium, Austria, Germany, and Russia, operate upon the English sugar market so as to prevent competition on the free trade basis of natural advantages, and thereby deprive English producers of their right to free trade competition in their own markets, inflicting upon them the necessity of withdrawing from the unjust competition, or of giving out of their own *profits and wages* the equivalent of the foreign bounty." He would not enlarge on the question, seeing that there were several speakers from a distance, but he would say a few words on the position of affairs as they affected the town of Greenock, in which they lived and earned their bread. Sugar was one of the staples of the town, and if it were taken away what would become of Greenock? He was sure they need go neither to France nor Holland to look for a day's work. They could all see the evils this bounty system was doing in Greenock. They had only to look, for instance, at the refineries that had been closed in Greenock already, and they could not tell when more would be closed in consequence of this unfair system. There were no less than four refineries standing idle. Some of these had been offered for sale, and they did not know when others might start operations. Then they had only to look at the numbers of men thrown idle by the stoppage of these works. One house now standing employed 200 men, another house 190, and another house 100 men. Where were all these

men to find employment? They had not found any since these works were closed. In Glasgow two prominent works which had wrought for many years had stopped; one in Leith, where many Greenock workmen and coopers were employed, had stopped; and one in Dublin, where also a number of Greenock men found employment, had ceased working. The result was that these Greenock men had come back to their town to look for labour and could not find it. If the sugar trade was taken away from Greenock where would working men find money to pay their taxes or School Boards—(laughter and applause)—and all the other burdens they had to meet? There was no use in saying that people would get cheap sugar, because any one who looked into the question knew very well, as had been very wisely remarked by the Chairman, that whenever the Frenchmen took away our refineries they would soon put taxes on the sugar they exported into this country, and take the taxes off their own people. (A voice, "They cannot produce sugar like Greenock." Laughter.) They in Greenock had taken up this question of the bounty in order that the working men in the town directly or indirectly concerned in the sugar trade might speak out in the matter. (Applause.) He would invite all Greenock working men to unite and consider the issues involved in order that they might see clearly the real grievance underlying this bounty system, and he was sure the working classes generally would sympathise with those engaged in the sugar trade. (Applause.) Let the Greenock working men engaged in the sugar trade do their utmost to bring about a change so that the French might not have the power to do anything they choose with one of the staple industries of the town. (Applause.)

Mr. ANDERSON, president of the Glasgow Coopers' Society, seconded the resolution. He said it gave him great pleasure to do so, in name of the journeymen coopers of Glasgow and suburbs. The most injurious system about which they had been hearing affected the trade of Glasgow very materially. He might state that a few years ago the works in Glasgow used to employ from 40 to 50 coopers, without exaggeration; and now they would scarcely see a cask made in the town for the purposes in question. He hoped that the combined efforts of the public—and he did not mean that section of it only which was directly interested in this question, for all sections were more or less interested (hear, hear, and applause)—might be the means of stirring up the Government to devise some means whereby this system, so injurious to the interests of the free trade of this country, might be done away with. (Applause.)

Mr. SAMUEL PETERS supported the resolution. He said he had heard one of the meeting say just now that the French cannot make sugar like Greenock, Well, he thought the party who said so was right; and he (Mr. Peters) said the French cannot make sugar like London or Bristol. (Hear, hear, and

bravo.) But they had managed by a breach of faith, and by breaking all principle of morality between nations, to supplant Bristol and London refiners in their own markets. They had bridged the English Channel; in a few years, or perhaps in a few months they would manage to bridge the borders—"Never"—and send their goods to compete in Greenock. ("Never") He could just quote a few statistics to say this, that the beetroot crop of France this year exceeded the last by 200,000 tons. There were in the future to be exported from France 200,000 tons of sugar in excess of last year, and England would receive her fair quantity of it; depend upon it. They might rely upon it that this question affected Greenock as much as it affected the South of England. Now, they must be perfectly aware that the markets of the continent of Europe were practically closed to the importation of English refined sugars. Before you could take into the markets of France one hundredweight of English sugar, you have to pay what the French call a surtax—but he called it a very large tax—of 5s. per cwt. and that practically excluded the English sugar refiner from exporting one pound of sugar into the French markets. He had no objection to France taxing her own people, because every country had a perfect right to collect its revenues in the manner it thought best. But what he objected to was that these countries were not content with closing their markets to the British refiner, but they encouraged their own refiners to send over their refined goods into this country with the system of a bounty to support the refiner. That he objected to as a breach of the principles of free trade. (Applause.) He wished to clearly point out one or two things to this meeting, and through this meeting to speak to the people of Scotland. Some people, and the greater part of the public, thought that by getting cheap foreign sugars they received a benefit. Well, France acknowledged to giving bounties to the amount of £800,000 per year; but it was proved by statistics that out of that £800,000 a sum of £500,000 went into the pockets of the French refiners, and consequently there was only £250,000 left for the benefit of the public. But he maintained that it was better for us to refuse that sum, even if it was a gift; and he would attempt to prove that practically it was no gift at all—that it was no good. Even if the continental sugars were equal to the West Indian sugars refined by the British refiners, was it wise for this country for the sake of a present of £250,000 per year to refuse the continuation of a trade that was valued at £200,000,000 per year? That was a question for political economists to answer. And he had the authority of great professors in this country to say that the sugar of foreign countries was of no benefit to the English consumers—(A voice: "Neither it is")—that the foreign sugar does not equal in sweetness nor does it go so far as the West Indian sugar refined by the British refiner. (Applause.) Well, then, to follow up the argument, let them look at the evil effects that this bounty system had upon the whole trade of

England in general. It was a great writer—John Stuart Mill, he thought—who said that the interest of one branch of a nation was the interest of the whole nation; and if you destroy one branch you hurt the whole tree. Well, he (the speaker) worked for many years in one of the largest refineries, at one time, he supposed, in the world. That refinery was in Bristol, and three years ago it employed 700 men, not including coopers, bargemen, or any other class indirectly affected by the refinery. They saw that to-day, instead of 700 men employed there were only 7, and these were kept to look after the machinery and see that the foreigner did not come and take that as well. (Laughter.) Well, he was going to show the effects the stoppage of one branch of labour had upon others. In six months after that refinery in the city of Bristol stopped, men that worked with masons, carpenters, and plasterers in that city received wages at the rate of  $4\frac{1}{2}$ d. to 5d. per hour, instead of 5d. to 6d. per hour which they had previously received. They thus saw the loss incurred in wages. Some people said they were asking that the sugar refining trade should be protected. Well, they had struggled on for 14 years, and the system had never yet been removed; and for 14 years they had worked against these French bounties, and were not vanquished yet. He meant to say that there was great vitality in their trade; and had they not been most devoted to their work they should never have been able to compete so long with the unjust system in practice on the Continent. He hoped the men of Greenock would that night pass the resolutions unanimously, and show to the country that they were determined to be alive to their interests, and show to the Government that they were determined to have free trade and fair play. (Applause.) He thought that the British sugar refinery operatives, with fair play and free trade, could compete, and compete fairly, with their continental neighbours. When they looked at their refineries which, as had been stated by a Greenock speaker, were standing silent, would they not regard them as a silent protest against the foreign bounty system, which was gradually stealing the trade from us? And if they were in Bristol or London and saw working men there walking about with nothing to do, and nothing for them in the future, it appeared, but the workhouse or the grave, would they say that this system should be continued which was the ruin of a fair and legitimate trade—an honourable British trade? Would they not rather say that it was an injustice which the Government should take immediate steps to rectify? He entirely agreed with the chairman that if the continental Governments would agree to refine in bond, then we should require no countervailing duty. But the foreign Governments had repeatedly promised to refine in bond, and had never kept their promise. M. Lèon Say, the finance minister, told the deputation that waited upon him that he could not see his way clear to refine in bond. This he said in opposition to his own Parliament. After that Parliament



had passed by 100 of a majority a resolution that the French refiners should refine in bond, the French Minister of Finance said he could hold out no hopes of refining in bond. If a nation would not keep faith with us, then it was nothing but an act of justice to teach her commercial morality by putting a countervailing duty upon her imported goods. (Cheers.) They had waited upon Sir Stafford Northcote, Chancellor of the Exchequer, and Sir Stafford held out hopes that the Governments would enter into fresh negotiations to try and settle this vexed question; and he (Mr. Peters) believed that the English Government were making efforts to bring the Government to some settlement. He had seen the Minister of the Netherlands, and he had promised to make fair representations of the case, and he believed that his Government would be willing to enter into a Convention if the other Governments would. But he (Mr. Peters) supposed that the country of the Netherlands had got a little more sense than we had, and they did not care about sacrificing their sugar trade if we care about sacrificing ours. He might say that this was a matter of serious consideration to us all. Some people thought it only affected the sugar operatives and those connected with sugar refineries; but if this country allowed one of her branches of industry to be destroyed she did a foolish action, for, with our increased population, we cannot afford to lose one branch of her industry. He wanted every industry kept open to us, and if we could open fresh ones, so much the better for our ever-increasing population. The sugar trade was a valuable one, or else our continental neighbours would not compete so keenly with us. England should take her place as the sugar emporium of the world, because the natural advantages of our colonies were so superior to those of the continent of Europe. One acre of West Indian grounds could produce as much saccharine matter as four acres of beet-root growing ground. The natural advantages, then, were upon the side of British refiners, and the interests of the colonies of Great Britain should be as keenly watched and studied as a parent would watch over the interests of a child. If we did not buy sugars of our West Indian colonies, how could our West Indian colonies purchase our calicoes and other stuffs, the manufacturers of which depend to a great extent upon their exportation? (Hear, hear.) The interests of London operatives, West of England operatives, and the Greenock sugar operatives are identical; and although perhaps in Greenock you have not felt it quite so sharply or so keenly as we have in the South, depend upon it that unless the foreign Governments are taught to trade with us in a fair manner, the beetroot goods would flood into our markets more next year than ever they had done before. This was a trade we had devoted our lifetime to, and we ask our Government to insist upon these nations competing fairly with us; and if after that they drive us out of our markets, we can say, like Britons, that we are beat, and retire from the competition.

But if they meantime beat us unfairly out of our markets, it is the duty of the Government of the country to see that the trade is not treated in an unfair manner and in direct violation of all the principles and doctrines of the great apostle of free trade, Richard Cobden. (Cheers.)

The Chairman having put the resolution to the meeting, it was carried by acclamation.

Mr. JOHN M'LEAN, treasurer of the Greenock Society of Coopers, moved the next resolution, which was:—"That diplomacy and treaty engagements having failed to stop these export bounties, it is the opinion of this meeting that it would be quite consistent with every principle of free trade to restore free-trade competition to the English market, and to intercept for the revenue the foreign bounties by levying against all raw and refined sugar exported to this country under such bounties a duty equivalent to the same. Provided that such duty be at once taken off as against any country abolishing bounties to the satisfaction of Her Majesty's Government." It was pretty evident (he said) that the French had no intention of adopting the system of refining in bond. A resolution in favour of that system had been passed in the Assembly in 1874 by 100 of a majority, but when they were asked by the deputation of those interested in the British trade why it was not carried into effect, they turned round and for an excuse said that political complications, changes of Ministry, &c., prevented them from carrying the resolution of the Assembly into effect. Yet they were quite well aware that for the last two or three years peace had reigned in France, and every opportunity had been given them to carry this measure into effect. (Applause.) Political economists had turned round and said that the proposal embodied in the second resolution would take us back to the old system of protection. Now, nothing of the kind was wanted. He trusted that the working men of Greenock as a body were free traders. (Applause.) But when other countries refused to carry out the principles of free trade and thereby tended to destroy an industry that was giving employment to thousands of working men, it became these working men to put forth an effort, and before the evil was accomplished to try if they could not by some means remedy it. It was said by an eminent writer that a nation's greatness consisted in the multitude of its people. That Britain was a great nation no one would deny, and the people of such a nation had duties of allegiance which they owed to the governors as loyal and peaceful subjects. On the other hand the people had claims upon their rulers, and rulers must protect the rights of the people. (Applause.) And this brought him to the second part of the resolution. That there was a grievance here all would admit, even the most bigoted political economists; and that being so, the next question that fell to be considered was how this grievance was to be removed. Fair means had failed, arguments had failed, logic had failed, and when these had all failed, it became the duty of the

people and of the Government to try some other means and see if they could not bring foreigners to their senses. (Applause.) They had heard of the state of trade in Bristol and the South of England, and it was right that some local facts ought to be brought prominently forward on this occasion. In the first place, then, they might take the state of their harbours at the present time. A few years ago at this season of the year the harbours used to be crowded with ships—sometimes two or threetiers deep—waiting on berths to be discharged. These gave employment to hundreds of working men, and caused the circulation of money through the town. Now, there was nothing to be seen but empty berths and light vessels, and if they looked around the quays and harbours they would find hundreds of men willing and able to work, but who could not find employment. (Applause.) Then, in the second place, look at the state of their sugarhouses, which had been referred to by some of the previous speakers. That sugar-refining was not a paying concern was very evident from the fact that so many of the refineries were shut up, and were not likely to be re-opened. Refineries that had been exposed for sale had not found purchasers, showing that refining was not at present a paying concern. When trade was good and prosperous they as working men looked for a rise of wages, and this had, in the favourable circumstances he had stated, at all times been conceded. But it was evident that the business was not paying, and instead of getting a rise of wages, they had to work at the old rate—(Voices : Lower)—while provisions had become dearer. In the third place, they might take a look at the West Indian shops even in our own town. In one of the large West Indian shops in town not many years ago there were no fewer than 100 men employed, and there was plenty of work found for them; but at the present day he understood there were not more than 20 in that shop, and even these were on half-time. Other West Indian shops in town were either completely shut up, or were doing little or nothing. All this was to be attributed to the pernicious system whereby bounty-fed sugars were sent into the British market. He had just received a letter from a very prominent gentleman in Bristol, which showed the extent of the injury that was being done by this system. He states that: "It may be right to state that the imports of sugar coming from our English colonies to the port of Bristol have declined from 77,000 tons in 1875 to 34,000 tons in 1877, which means the non-employment of a fleet of 60 ships and the throwing out of work of thousands of honest working men." (Applause.) The next question was how this state of things was to be amended. It had been shown that fair means had failed. The only course, then, to be followed was to impose a duty or tax equivalent to the amount of the bounty or bonus given by the French and other Governments to their refiners. Now, even in our own town they had met some of those so-called free-traders who could not see their way to support such a proposal. We all as free-traders would

much rather not impose such a tax, but we consider it was only fair that these people should be dealt with in this manner, so as to induce them to compete with British refiners on fair terms. When this tax was imposed they would enter the market on fair terms and carry on their business in a lawful and just manner. (Applause.)

Mr. WILLIAM YOUNG, cooper, seconded the resolution. He said that in a community where most people had free trade principles at heart, the idea of a countervailing duty might look somewhat suspicious. But it would not be fair if they did not look to their own interests. The sugar did not drop into the town; it did not come to them like the rain. (Laughter.) It had to come by ships. Consequently, if there was no sugar coming to Greenock there would be fewer ships, and if there were fewer ships required there would be fewer carpenters, blacksmiths, riggerst and other classes of workmen. The state of the sugar trade influenced the whole community. It was a great drawback that they had to fight against, and a countervailing duty had been suggested. The French knew perfectly well that they were doing an injury to the British sugar refining industry, as well as the people in this country engaged in the trade knew they were suffering. The French could well afford to pay a bounty, knowing as they did that they were fostering a great industry in their midst. As showing the difference between the price of sugar in this country and in France, he would tell them that a gentleman who was in Paris a few days ago had informed him that he paid sevenpence for a pound of sugar in a Paris shop, and the same article could be bought in London for threepence per pound. That would give them an idea of the amount of money that was being put into some particular person's pockets for carrying out this iniquitous system. There was a great talk about this Léon Say. He had a great deal to say—(laughter)—on that subject. He (the speaker) was led to understand from a great authority that Léon Say was interested in a large beetroot business. So nothing need be expected from him. Not a bit of it. What those engaged in the sugar trade wanted was that the British Government should put on a countervailing duty upon bounty-fed sugars; and that countervailing duty could be taken off as soon as the bounties were abolished. As his friend from Bristol had said, the British as a nation could compete fairly with any other country in any trade—(hear, hear, and a voice, to a person who had been interrupting the speaker, "Shut up")—and if once the British could not compete on fair terms with any other nation, then they might shut up. (Laughter.) Napoleon the First tried to lick us by force of arms, but he failed. But mark you, if they could not lick us by force of arms they could lick us in diplomacy, and they were doing it now; and as soon as they get us into bankruptcy,

poverty, and rags, they will put on the screw; don't be feared but they will. (Laughter and applause.) He would like that the working men of Greenock would pay particular attention to the articles in the newspapers on the subject. Let them edify themselves regarding it, and he had no doubt that when the next meeting was held to consider the subject, the hall would be packed. There were thousands in Greenock, who did not know anything about the sugar question, but now that an agitation had been commenced they would become edified in it, and they would make up their minds not to give up the agitation until they got satisfaction. (Applause.) He hoped the various branches of trade assembled to-night would appoint one or two of their number to act with the committee, and no doubt they would carry out the agitation to a satisfactory result. (Applause.)

Mr. THOMAS KELLY rose to support the second resolution. He thought if they could show to the public—that is, the consumers of sugar in the United Kingdom—that it was not a cheap sugar that they got when they purchased beetroot sugar, they would then have accomplished a very great step in prohibiting them from purchasing any more beetroot sugars. He believed it could be borne out by chemical analysis that the beetroot sugars that are grown in France or any other continental country did not contain anything like the quantity of saccharine matter that was contained in the productions of our West Indian possessions. If he was asked for his authority he would refer to what took place at a conference which he and five other representative working men had with Professor Henry Fawcett, member for the burgh of Hackney, three weeks ago. Professor Fawcett then declared, and gave us permission to say to the friends outside, that he would rather pay  $\frac{1}{2}$ d. per lb. more for colonial sugar than use beetroot. He said he never purchased a pound of beetroot sugar, and he supplemented his remarks by saying, "You trust me having any beetroot in my house." (Applause.) He (Mr. Kelly) thought, therefore, it was quite clear that beetroot sugar was not sugar. The *Scotsman* had said lately that we ought to accept cheap sugar, and say nothing at all about it. He thought that before they had used the word "sugar" they should have seen the material they spoke of put through a chemical analysis. (Applause.) The question of cheap sugar cuts two or three ways. If it was to be laid down as a declared rule or principle that we must have cheapness in sugar, why should we not have cheap loaves and cheap fishes, as well as cheapness in all other productions? The argument must apply generally and not particularly. People who go only a portion of the way with us said that we ought not to talk about a countervailing duty, but that we should confine our efforts to the principle of refining in bond. If he was not mistaken, the British Sugar Refiners' Association—that is, the master sugar refiners—had been for seven years advocating that principle, and had got no further than

the blind ass got that was tied to the tombstone, and got no further than the tombstone when it was found in the morning. (Laughter and applause.) He did not think they should confine their efforts to advocating the principle of refining in bond alone, because every effort and power under heaven had been directed by the syndicate of capitalists, refiners, and brokers to bring about the desired object, but they had done nothing towards it. He believed that their neighbours in countries across the channel, and Frenchmen especially, would respect the opinion of the working men of Great Britain, when they expressed it, much more than they would respect the opinion of the masters, with all respect to them. He believed, then, that we should advocate the principle of the countervailing duty, and if they are willing, when we have passed that countervailing duty, to refine in bond, we will then be able to do away with the countervailing duty. He did not think the French refiners would adopt the principle of refining in bond, and he would tell them why. M. Léon Say, addressing the delegates who waited upon him, said—"As for refining in bond, it implies a great loss to the manufacturer. You have experience of this difficulty with your distillers. You oblige them to put their goods in bond under lock and key, in the surveillance of your Government officials, and you practically offer a bonus to those who export their produce, and thus spare you trouble and expense. We should, of course, be obliged to make a similar reduction to exporters. This is the point to which we should be obliged to pay great attention in order to secure fair play, in the event of our agreeing to an international Convention." That was the statement of M. Léon Say. He is brother of the greatest refiner in Europe, and is it not supremely ridiculous for any person to advocate the principle of refining in bond, when they recognise in M. Léon Say one of the standard interests in keeping up the system of the bonus to exported sugar? (Applause.) He had the deepest respect for their chairman, and he knew that that feeling was shared in by the working men of London—(applause)—but he differed from the Chairman when he said that he hoped and trusted the thing might be done without the adoption of the countervailing duty. The Chairman had greater experience than he, but he was free to express and declare his belief that Frenchmen would never refine in bond without he was forced to do so by the unmistakeable declaration of the working classes of Great Britain and Ireland. (Applause.) He could prove by the Blue Book which he held in his hand, that four years ago the principle of refining in bond was carried in the French Assembly by a majority of 100 votes. It was M. Pouyer-Quertier, the French Finance Minister of that day, who, in moving that the bounty system be abolished, stated that the French sugar refiners were paid a sum of 20,000,000 francs, and his estimate had never been disproved. The House of Assembly, agreeing with the representations

of the Finance Minister, voted his proposition by a majority (as he had already said) of 100. A change of Government took place, and the proposition was turned over to the tender mercies of M. Léon Say, who, three years afterwards, tells us—"We cannot carry out this principle of refining in bond." The Dutch Minister in London tells us it would be impossible for the Netherlands to carry out the principle of refining in bond without the French lead the way, because it would only be putting a small eel into the mouth of the great French shark. (Laughter and applause.) He was a free trader. He would go further, and say he was a radical free trader; and it was to some extent harsh to his feelings to impose a countervailing duty. But it was a necessity, and was warranted by the experience which had accumulated upon the consideration of this important question. The countervailing duty was the only remedy, and it did not touch the principle of free trade. (Applause.) The *Scotsman* which he had purchased at the office in Fleet Street, London, the other day, said the British operative sugar refiners wanted protection; wanted to impose a countervailing duty, and that that duty meant protection for the sugar industry. Now, he thought he could quote as high an authority as the *Scotsman* to disprove the reasoning of that great journal. He could not do better than read the authority of Mr. Cobden, the father of free trade. He was quoting from the edition of Mr. Cobden's speeches by Mr. John Bright and Professor Thorold Rogers: "Now, let me be fully understood as to what free traders really do want. We do not want cheap corn merely in order that we may have low money prices. What we desire is plenty of corn, and we are utterly careless what its price is, provided we obtain it at the natural price." "We do not seek free trade in corn primarily for the purpose of purchasing it at a cheaper money rate; we require it at the natural price of the world's market, whether it becomes dearer with a free trade—as wool seems to be getting up now after the old a pound—or whether it is cheaper, it matters not to us, provided the people of this country have it at its natural price, and every source of supply is freely opened, as nature and nature's God intended it to be. Then and then only shall we be satisfied." We want (said Mr. Kelly) fair competition, and we do not care who competes with us, whether it is the Heathen Chinee or the accomplished Frenchman. (Laughter and applause.) We do not care whose land sends us produce if we require it. What we stipulate for is that it shall be natural produce. As our ports are open to the productions of the whole world, they must come into our ports subsidized by no secret state aid. We want plenty of natural produce sent in to us at a natural and not an artificial price. If any gentleman should read the newspaper called the *Scotsman* and find it stated there—and they are smart writers, these *Scotsman* writers—that you working men who have been free traders and are affected by the principles of free trade, want protection, you can tell them

we do not want protection ; we want natural productions at natural prices. (Applause.) He did not think he could do better than read what the Chancellor of the Exchequer said upon the question. Replying to a leader of the *Times*, which had followed its neighbour the *Scotsman*, the Chancellor of the Exchequer said : " He knew it had been said sometimes—he saw it put strongly in the journals—that if foreign countries chose to pay bounties, or anything of the nature of bounties, on the sugar which they exported, and thereby supplied us with an article cheaper than it would otherwise be, we as a nation had nothing to do but to take advantage of their folly, and that we need not trouble ourselves as to the effect it had on this or that trade ; but he wished to say that he entirely dissented from that view." If any man rose in Greenock and said he wished to go back to the days of protection, he (Mr. Kelly) would ask him to go into his secret closet and try to study the secrets of the sugar question. (Applause.) Mr. Kelly went on to say that by using the sugar grown in our West Indian possessions they would get real sugar, and not be semi-poisoned by one of the most mysterious combinations of materials under heaven. (Loud laughter.) If any one told him that the French beetroot sugar had not killed one of the most ancient and most honourable industries this country ever possessed, he (Mr. Kelly) would tell him he knew nothing about it. He would show such an one the West Indian docks of London, and tell him that out of 600 coopers who 10 years ago were constantly employed on the docks, to-day employment could not be found for 220. He would point out to such an one that the City of Bristol, which was the chief port for the West Indian production had declined in the West Indian imports, in sugar alone, more than 100 per cent. They had, therefore, some ground to stand upon in arguing for a countervailing duty. Mr. Kelly quoted figures to show the increase in the imports of beetroot sugar from France, and its effect upon the trade of our West Indian possessions. Here they saw one of the finest districts on the surface of the globe going, as it were, to the bad, because its productions were forced out of the market, in consequence of this system of bounties granted by the French and other nations. They should all unite, and sugar refiners, coopers, dock porters, sugar porters, sugar warehousemen, enginemen, and all others directly or indirectly affected by the system, should be represented on one central committee, and they should show that they were determined, if they had power of speech and energy of action, not to slacken their efforts throughout the length and breadth of the country to induce the Government—which does not want inducements after all, if the people will only speak out—to impose a countervailing duty. (Cheers.)

The Chairman put the resolution to the meeting, and it was carried unanimously.

Mr. JOHN WEIR, cooper, moved the third resolution—" That copies of the



foregoing resolutions be ordered by this meeting to be sent to the Chancellor of the Exchequer, Mr. Gladstone, M. Gambetta, and the Ministers of the various countries granting bounties on the export of raw or refined sugar."

Mr. WILLIAM WILSON, secretary of the Sugar Porters' Association, seconded the resolution, and it was also duly approved of by the meeting.

Mr. DAVID M'COLL, secretary of the Coopers' Society, moved a vote of thanks to the Chairman, and three hearty cheers were given for the worthy member.

The CHAIRMAN, in acknowledging the compliment, said he had only been where his duty called him.

Mr. YOUNG moved a vote of thanks to the delegates from London and Bristol.

Mr. PETERS returned thanks. The meeting then terminated.

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At a meeting at Bristol on the 20th ult., the following letter from the Chancellor of the Exchequer's office was read:—

"11, Downing Street, Whitehall, Aug. 14th, 1878.

"Sir,—I am desired by the Chancellor of the Exchequer to acknowledge receipt of your letter of the 13th inst., sending him copies of resolutions passed at a mass meeting at Greenock on the subject of the Sugar Bounties. And I am to say that the Government are fully alive to the importance of this question.

"I am, Sir, your obedient servant,

"JOHN A. KEMP."

"Mr. S. Peters, the General Secretary of the  
Executive Committee, Bristol."

It was stated that meetings were in course of organisation in Edinburgh, Glasgow, Plymouth, and other towns.

Since then an important town's meeting at the large Colston Hall, in Bristol has been announced for September the 9th, at which the Mayor of Bristol is to preside.

It is also reported that meetings are to be held in Liverpool and Manchester.

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THE SUGAR CANE AND THE TOBACCO PLANT FROM  
AN AGRICULTURAL POINT OF VIEW.

BY DR. T. L. PHIPSON, F.C.S., &amp;c., London.

*Formerly of the University of Brussels, Member of the Chemical Society  
of Paris, &c.*

The vine, the sugar cane, and the tobacco plant, are among the most interesting products of the vegetable kingdom when we consider them from a purely agricultural point of view; for, there are no plants, as far as we know at present, with the exception, perhaps, of the *Cinchona* species (a recent experience), and the Beet that respond in a greater measure to the influence of methodic culture.

As we advance from the tropics to the polar regions we find vegetation becoming more and more stunted; the plants are reduced in many cases to the state of dwarfs, as if to enable them to resist more effectually the intense cold, and to profit, as much as possible, by the smaller degree of warmth and light radiated to them by the sun.

In the tropics, vegetation is infinitely more vigorous than in colder regions; in other terms, a tropical plant, such as cane or tobacco, takes a larger amount of nourishment in a given time. Thus the *same* species of tobacco leaf cultivated in Virginia and in Germany, will make use of the same elements supplied by the soil, but, in the former locality, it will vegetate more rapidly, and will exhaust the soil sooner than in Europe. The same argument applies, of course, to all plants cultivated in the tropical regions. Their vigorous vegetation tends to exhaust the soil more rapidly than is the case with us in Europe; and consequently it is to the tropical regions that artificial manures should have been *soonest* applied, whereas they are the *last* localities in which they have been adopted.

As if nature had foreseen this, vast deposits of guano, a most powerful manure, have been deposited in these tropical regions. But man, ever ready to proceed contrary to nature's laws, carries these deposits to the temperate zones and applies them there! To make up for this, the ingenuity of the scientific chemist has com-

pounded artificial manures to suit not only the tropical plants under culture, but to ensure the prolonged fertility of the regions in which these manures are methodically employed.

The tobacco plant requires what may be termed a clean manure: the ordinary artificial mixtures, containing animal matters and refuse of all kinds, are apt to produce a coarse leaf with a disagreeable flavour, which, however large the crops, is most prejudicial to the grower. Ammoniacal manures, such as guano; *i.e.*, Peruvian guano, pure or dissolved, are not much better in this respect, unless used with the utmost care; whilst stimulating and favouring a rapid growth of leaf they facilitate the rapid exhaustion of the soil, so that in the course of a few seasons very unsatisfactory results may be looked for.

Abundance of carbonic acid, nitric acid, (or rather nitrates and nitrites) plenty of moisture in the soil and air, and a copious supply of potash with phosphates, lime, magnesia, and a moderate amount of chlorides and sulphates, such appear to be the chief elements of success in the cultivation of the tobacco leaf of first rate quality; and these, I believe, are the principal considerations which have guided Mr. G. Washington Arnott, F.C.S., in the production of what we may safely consider the only perfect manure for the tobacco plant hitherto produced. I have analysed this product with considerable interest and am convinced that there is as yet nothing like it. By its composition it is calculated to supply all the ingredients required by the leaf and to prevent the exhaustion of the soil in a given district, however great the number of years which the tobacco plant is cropped thereon. More than this, it supplies these ingredients in the forms best suited for assimilation, which is a most important consideration, and it is quite devoid of animal matters or refuse in a state of decomposition which, as we have already stated, are known to be prejudicial to the quality of the leaf.

This ingenious product was examined recently by me with much pleasure, for I have long taken a deep interest in all matters pertaining to the culture of tropical plants, and the first thing that surprised me was to find that it contained a certain amount of nitrate of ammonia, upon which its nitrogen yielding powers entirely depend.

All agricultural chemists will admit that nothing could be better for the genus *Nicotiana*. Its phosphates, potash, and lime compounds are all in the best condition for assimilation. At last, then, it may be said that we possess a tobacco manure properly so-called, which, though it may be found to benefit other crops, is *specially* adapted to the cultivation of the genus *Nicotiana*, and will, I am persuaded, meet with approval all over the world. Let us hope that it may be the means of improving our colonial tobacco, and permit our British Islands to complete successfully in this respect with Cuba.

Wherever cane is cultivated tobacco can be grown. More than this, when a soil is found to be decidedly inimical to cane culture, tobacco can, in nine cases out of ten, be reared there luxuriantly. Again, the culture of tobacco for a certain number of years upon this soil, with the aid of the special manure to which we have alluded, where cane culture has become unproductive, will have the effect of rendering that soil again as fertile as ever it was for cane culture, probably more so; so that in the course of six or eight years cane plants could be inserted again there with a certainty of success.

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The President of the Republic of Guatamala, by a decree of 3rd April, 1878, made the following dispositions in regard of the exportation of sugars.

Ar. 1st. From this day the exporters of "Mascabado" (grainy sugars) will receive an indemnity of 4 reaux (about 2.75 frs.) per quintal, as a return for the tax on canes and the customs tax on empty sacks.

Ar. 2nd. The certificates proving the shipment will be examined by the port officials, and will be exchanged, by the central administration, against the certificates called "goods of exportation" (*Bonos de exportacio*), remitted to the agent or trustee, who could realize or offer them in payment of the cane tax, established by the laws of 16th June, 1872, 11th February, 1873, and 24th May, 1877.

## BEET ROOT SUGAR DIFFUSION.

*Continued from page 370.*

We will now proceed to drying the roots. In this as in every other process there will naturally be considerable differences of opinion, and I grieve to have to differ from established authorities. Walkoff speaks of the root slices being dried in an hour; other authorities who have lately visited the diffusion factories in Germany also speak of what appears to the writer an incredibly short time for dessication; these latter speak of the cut roots being piled to a great thickness on the floors of the kiln. I am convinced they are wrong. Roots, when *once dried*, can no doubt be heaped to a considerable depth on the floors of the kiln, so as to finish and harden them, but they will not bear these depths when first placed on the kiln.

My experience shows that the thinner the cut roots are placed on the shelves the better, and that under the most favourable circumstances of draught the layers ought never, in the first place, to exceed  $2\frac{1}{2}$  inches, less is better, and that, do what you will, no kiln of roots can be dried in less than twelve hours,—reason and experience is altogether against it. Malt cannot be dried in less than twenty-four hours, even after it has been exposed to the drying of the atmosphere, and has supported a considerable amount of growth for many days.

Beet root, cut it up as you will, contains more moisture or water than malt when ready to go on the kiln; and it must not be exposed to a greater heat than malt; why therefore should it dry more quickly? It is contrary to the nature of things that it should do so, or, at all events, that it should dry in an hour, as Walkoff states. However, treating the time of drying the roots as an uncertain, and vexed question, only to be settled by the actual operators, according to the fuel used, the draught of air through the kilns, &c.; the roots must be cut in *small* pieces, and dried with fire heat, either in a kiln with an open anthracite fire; or, if smoky fuel is used, the floor of the kiln must be heated by iron pipes through which the heat, and

results of combustion pass, thus affording sufficient drying power. Where there is much waste steam, the kilns may be heated by the waste steam passing through convoluted pipes under the perforated floor on which the cut roots rest.

Whatever kind of heat is used, the roof of the kiln above the pierced floor must be thoroughly "ceiled," and protected from the weather, and cold draughts, so as to prevent the steam which passes off from the roots from condensing, and falling back on them should it do so; and alteration *must* be made until the evil is abated. The chimney from the kiln must be carried to such an height as to ensure a good draught of air through the roots; the more air that passes the quicker will be the drying.

The Americans are great advocates for the hot blast in drying, they insist on it that kilns for dessication work better with the hot blast, than each kiln having a separate stove. The largest starch factory in the United States uses the hot blast, issuing from a great stove heated chamber—the air been driven by a fan urged by steam power. They dry their starch in cubes of 6 inches face (cubic contents 216 inches) each block. The kilns are piled full of these blocks, each separated from the other by about one inch of space; they work continually, night and day; and it only takes 4 days and nights to dry a kiln complete.

Having given this general information on kiln drying, we must leave each party to carry out his own ideas in accordance with circumstances.

The shape of the pieces cut is important, they should be as thin as possible, and cut in narrow and ribbon-like pieces; many cut them in a prism shape, and allege that they lie more open, both to the action of the heated air in drying, and to that of the hot water in diffusion; but whatever shape they are cut, the tool used for the cutting must be a *sharp* one, and make a clean smooth cut. In Germany it is alleged that they sharpen the knives four times a day, as has been before stated; the cut roots oxidize but little when cut with a sharp tool, but when a blunt tool is used the oxidation is very great. When the roots are once thoroughly dried, they must be carefully stored in such a way as not to be exposed to currents of air.

The dried roots are very hygrometric, and absorb water quickly from the surrounding air. The roots of chicory are cut in pieces about one inch thick, and the size of the root; and they take more than one day to dry on the kiln floors. It is not well known whether the dried beet roots are affected by any particular disease; chicory roots are subject to a worm when they get damp from exposure in summer. No doubt dried beets will be subject to some casualties.

In diffusing the dried roots the process is the same as with green roots,—diffusing, drawing off, and reheating the water of diffusion before again adding it to the next vessel, and continuing the operation in the several “batteries” of vessels until the whole of the soluble contents are extracted;—when the exhausted, root slices are turned over to the cattle troughs or cisterns, or to the “silos,” and covered up with earth when intended to be kept over the season. These spent roots, thus preserved, keep well when safely covered,—and, from the quiet fermentation which goes on, develop a good deal of lactic acid, and other properties which render them very useful and palatable to the cattle,—more so, it is said, than even the freshly exhausted roots.

The use of phosphoric acid with the dried roots is considered very important in cleansing the juice or syrup, and the straining of the juice through so many mediums saves the trouble which arises from excessive scums in defecation, and almost entirely does away with filter presses. The phosphate of lime left in the slices or “cossettes” is very beneficial to the cattle, and, of course, the full value of it is obtained in the manure, so that the use of the phosphoric acid entails no absolute loss, but affords a most important item in the business.

I am just reminded by a practical friend, well acquainted with the German method of working, and who is a German sugar maker, that the system of drying beet roots has prevailed in many of the largest factories for the last twenty years; that it has been adopted and abandoned according to the times, but that now the advantages of diffusion are fully known, the drying of the roots comes in as a natural portion of the business.

I may here remark that, at present, simplification of the business and machinery seems to be the object of manufacturers; hitherto (and this shows what enormous profits the business must have yielded) nothing seems to have been too costly, or too complicated. Any person who will study Walkoff, or any other work in which the machinery of beet sugar making is portrayed, will see that the manufacturers seem to have adopted any new and expensive piece of machinery which offered—where the simplest thing would have done equally well. In grinding and pressing the current expense for bags, hydraulic presses, &c., &c., was almost enormous; all this is now found to be needless—diffusion extracts the sweets from the roots with not more than fifty per cent of water in addition to the original juice, and no manufacturer under the old system completed his work with a less addition of water than this, besides, even if diffusion took more water, it is merely a question of evaporation,—and a tenth part of the extra annual cost entailed by the old system would furnish means for the necessary evaporation of a weaker extract than we can obtain by diffusion,—besides the saving of lime, and the cost of using it, and getting rid of it, when its end is answered, and the mass of machinery connected with the scum presses—a great part of which at all events is now done away with.

The entire capital stock of many German factories is now represented by abandoned buildings, and heaps of condemned machinery, which now serve no turn, but to show as an asset in the books, where they should long since have been written off to Profit and Loss.

E. L. C.

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## RESULTS OF THE CONCRETOR.

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We have been favoured by Mr. W. F. Ashby with the following valuable statistics of the results of the Concretor at the mill of the late Umhloti Sugar Company. They appear to be highly satisfactory, and we shall be glad to receive similar information from other quarters.



## CROP—1876 AND 1877.

No.	Month in which Cane was Crushed.	Description of Cane.	Weight of Sugar Bagged.		Average Density from Mill.		Total No. of Gallons of Juice.	Lbs. of Sugar per gall. of Juice.	No. of Wagon Loads of Cane delivered at Mill.	No. of Wagon Loads per ton of Sugar Bagged.	Highest Price realised in London Market, per cwt.	Lowest Price Ditto.	Average Prices.
			Tons.	cwt.	qrs.	lbs.	No. of Clarifiers (400 gals.)	Degs.					
1	November, 1876	Green Natal plant Cane	78	14	1	26	216	9 to 10	86,400	2.04	20s.	19s.	24s. 9d.
2	December, 1876	First ratoon China Cane	12	11	3	20	33½	9	13,600	2.07	23s.	22s. 6d.	22s. 9d.
3	December, 1876	Green Natal plant Cane	23	10	1	4	..	..	..	..	22s.	19s. 6d.	20s.
4	Dec., '76, & Jan., '77	Green Natal plant Cane	36	16	0	26	262½	10½	105,000	1.86	26s. 6d.	23s.	24s.
5	Jan. and Feb., 1877	First ratoon, green Natal	35	5	0	19	99½	12	39,900	1.98	26s.	25s.	25s. 7d.
6	February, 1877	Green Natal plant Cane	40	4	0	8	117½	10	46,900	1.92	24s.	20s. 6d.	21s. 7d.
7	February and March	Green Natal plant Cane, small quantity of China mixed	44	7	2	18	134	10	53,600	1.85	22s.	19s.	21s. 4d.
8	March	Natal and China mixed	17	2	2	9	56	9	22,400	1.71	18s.	18s.	18s.
9	March	China Cane, plant Crop	3	13	2	14	14½	9	6,700	1.57	18s.	18s.	18s.
10	March	First ratoon, green Natal	17	1	2	20	55	9½	22,000	1.73	21s.	19s.	20s. 9d.
11	March and April	Natal and China mixed	110	6	2	14	354	10	141,600	1.74	21s.	17s. 6d.	18s. 6d.
12	May	First ratoon, Natal Cane	13	4	0	15	36	10	14,400	2.05	21s.	15s. 3d.	15s. 4d.
13	May	Natal and China mixed	12	10	1	20	..	..	..	..	15s. 3d.	15s. 3d.	15s. 3d.
14	May and June	Natal and China mixed	47	13	2	14	149	9	59,600	1.79	..	..	..
Total Crop			543	7	2	3			610,900	1.86			
Deducting the two lots Nos. 3 and 13, where the number of Clarifiers are unknown			36	0	2	24			610,900	1.86			
Leaves			507	6	3	7			610,900	1.86			

610,900 gallons of Juice gave 507 tons 6 cwt. 3 qrs. 7 lbs., being at the rate of 1.86 lbs of Sugar to the gallon of Juice.

## CROP—1877 AND 1878.

No.	Month in which Cane was Crushed.	Description of Cane.	Weight of Sugar Bagged.		Average Density from Mill.		Total No. of Gallons of Juice.	Lbs. of Sugar per gall. of Juice.	No. of Wagon Loads of Cane delivered at Mill.	No. of Wagon Loads per ton Bagged.	Highest Price realised in London Market, per cwt.	Lowest Price Ditto, Ditto.	Average Prices.
			Tons.	cwt. qrs. lbs.	(1000 lbs. to 1 cwt.)	Degs.							
1	August 13, 1877	China Cane, burnt	50	1 0 6	29½	7	11,800	1.33	98	14	17s.	17s.	17s.
2	September	China Cane ratoons	7	0 2 16	29½	7	11,800	1.33	98	14	17s.	16s. 3d.	16s. 3d.
3	September	Natal plant Cane, flowering heavily	9	4 2 25	26	9½	10,490	1.98	60	6½	18s.	17s. 6d.	17s. 8d.
4	September & October	Natal plant Cane ratoons	112	9 2 27	314	10	125,600	2.00	899	8	18s.	14s. 6d.	15s. 11d.
5	November	Very old & poor China Cane	10	15 2 14	44½	6½	17,700	1.38	..	..	16s. 6d.	15s. 6d.	16s. 2d.
6	November	China and Natal	52	15 1 9	160	9	64,000	1.84	..	..	..	..	..
7	December	Green Natal plant Cane, with some China	43	1 0 25	144	9	57,600	1.66	391	9	17s. 6d.	15s. 6d.	16s. 6d.
8	Dec. and Jan., 1878..	Green Natal plant and part young ratoons, with little China	62	5 3 25	208	7 to 9½	83,200	1.67	394	6½	18s. 6d.	17s.	17s. 4d.
9	Jan., Feb., & March	Green Natal plant and China	142	19 3 27	509	8 to 9	203,600	1.57	..	..	17s. 6d.	15s. 6d.	..
10	April	Natal Cane, old ratoons	10	2 0 14	31	10	12,400	1.82	100	10	..	..	..
Total Crop			500	16 1 20									
Deducting the lot No. 1, where the number of Clarifiers are unknown			50	1 0 6									
Leaves			450	15 1 14			586,300	1.72					

586,300 gallons of Juice gave 450 tons. 15 cwt. 1 qr. 14 lbs., or at the rate of 1.72 lbs. of Sugar per gallon of Juice.

For 1877-1878 crop I have with lot 1 only the account sales by me of 32 out of the 50 tons, which realised as above. With lot 9 I have also only the account sales for a part, and of lot 10 no account sales yet received.

1877-1878 crop had suffered much from drought, and I estimate the yield per acre to have been 35 per cent. less than in 1876-1877 crop, which was not a heavy one, having also felt the want of rain, but not to the same extent. The yield of sugar from the juice was also less.

From the prices realised in the London market has to be deducted the charges for dock dues, sorting and lotting, rent, marine insurance, advertising and catalogues, brokerage and commission, amounting to about 34s. per ton; also charges in Natal for railway carriage, transport from estate, bags, shipping, &c., about £2 per ton, and loss in weight, freights varying from 17s. 6d. to 30s.—in round numbers, say £5 per ton.

I hope returns from some of the mills working the vacuum pan will be published, that we may be enabled to compare the two systems.

W. F. ASHBY.

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### WINDROWING CANE.

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In our April issue of this year we copied from the *Louisiana Sugar Bowl* an article on the "Treatment of Frosted Canes," by Mr. David Ker, in which the term "windrowing" was introduced—a process with which many of our readers were unacquainted, and wrote to us for information upon. This we are now enabled to give, in the following editorial from the same journal:—

"In a published report of the condition of the present growing cane crop of Louisiana, made at this month's meeting of the Sugar Planters' Association, [June, 1878,] the following paragraph attracted our attention:—

"'Seventy-five per cent. of the bad seed this year was occasioned by the wet rot, having suffered in windrow, in which way most of the seed was put up—at least 85 per cent.'

“This brought to mind a conversation which we recently had upon this subject with one of the oldest practical sugar planters of this State. He says that the usual method of windrowing, by throwing into one furrow from two to four rows of cane, in such position that the tops of the last thrown down will always cover the butts of that just deposited, will do well enough for protection against frost while awaiting the mill; but for seed, cane should never be windrowed in that careless manner, as is almost universally done, with only the addition of a furrow of dirt thrown on from each side. The proper way to windrow cane for seed is *first* to throw to the centre of the water-furrow one or two furrows of dirt from each side, run a harrow over that so as to pulverise it thoroughly and give the cane a soft bed to lie in, and of such an elevation that it cannot be injured by water standing upon it during the wet winter months. Upon the cane he throws from two to four more furrows of dirt to protect from the cold. Of course it is very difficult to plow and harrow between rows of heavy cane, but our friend contends the importance of keeping seed in a sound condition justifies all the time necessary for this method; and if the cane is crooked, or otherwise interferes with the team passing between the rows, he cuts away a sufficient quantity of the cane to *make* room. In this way there is no difficulty in keeping seed cane, and had our planters so put down their seed last fall, we would not now read, ‘Seventy-five per cent. of the *bad* seed this year was occasioned by the wet rot, having suffered in windrow.’ On this point the report concludes:—

“The seed put up in round mats as a general rule kept the best, having been less exposed to moisture, though in several cases this was not infallible.’

“This is a strong argument in favour of round mats, or standing the canes upon their butts on a dry piece of land, and throwing a little dirt around the outside to the height of three or four feet. The cane from about one half-acre is usually put in each mat. This method, however, is but little used, although Mr. F. O. Darby claims a patent on the round-mat system, with the addition of a square wooden tube running up through the centre for ventilation,

to prevent dry rot. The flat-mat method of preserving seed (laying down as in windrowing, in beds about fifteen feet wide, on elevated ground, to the depth of from two to four feet, then lightly covered with earth) is much more common and popular; but either round or flat mats require more time than most planters are willing to give, and yet the losses of seed cane this year are so easily accounted for that we hope henceforth the proposed plan of elevating the ground upon which it is to lie in windrow will be generally used. In the hurry of the time, too many planters seem to overlook the importance of care in putting down seed cane, but the frequent disappointments of the planting season should have taught a salutary lesson by this time."

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#### CONTINENTAL NOTES

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Since our last we have been favoured with some especially fine weather, of which every advantage has been taken. Throughout the beet district the crops look well, all the plants showing good leaf, although the root is rather small considering the advanced stage of the season. However, notwithstanding the bad weather of May and June, if we have a continuation of favourable weather a full and good crop may be expected.

During the month of June the French *fabricants* had two good opportunities of airing their opinions on legislation, both international and internal. At the International Congress of Agriculture, M. Jacquemart, in an excellent speech, sketched the present situation, and concluded with moving the abolition of bounties in all fiscal legislation, which was unanimously carried; and again at the Session of the Central Committee, where the discussion of the general customs tariff and of the interior *regime* was the subject of a special examination.

M. Tardieu, the editor of *La Sucrerie Indigène*, thus refers to the question:—

"In the *Projet de Tarif*, imported sugars taxed by the 100 kilos., the tenths, and the 4 % of the law of the 30th December, 1873, comprise:—

1. Unrefined sugars under type No. 13.....	65·32
2. „ „ from No. 13 to 20 inclusive	68·64
3. „ „ above No. 20 ( <i>poudres blanches</i> ) of the French colonies and possessions	70·20
4. Unrefined sugars ( <i>poudres blanches</i> ) foreign ..	73·84
5. Refined sugars of the French colonies and possessions .....	73·82
6. Foreign refined sugar, sugar candy, &c.....	85·50
7. Molasses for distillation .....	exempt
8. Molasses for all other uses having a saccharine richness of 53 % or less .....	22·308
9. Molasses for all other uses having a saccharine richness above 53 % .....	65·52

“The unrefined sugars (other than the *poudres blanches*) of European manufacture will continue to pay the surtax affixed to similar foreign sugars taken from *entrepôts*.”

From this table we see that sugars comprised under numbers 1 and 2 imported from foreign countries will pay the same as sugars from the interior, plus the surtax as stated in the last paragraph, and which in effect puts the importation duty at 68·64 and 71·76 instead of 65·52 and 68·64, or 3·12 of surtax in each case. It must be further remarked, that these sugars are not open to temporary admission. The last paragraph does not say if, as to-day, the surtax of 3·12 will touch the molasses as in Numbers 7, 8, and 9; but it is probable, the more so that their richness will be found to rise 3 %; which is only 58 % in the actual tariff. On the sugars number 4, until now prohibited, there will be put a surtax of 3·64 (73·84—73·20). The sugars Number 6, also prohibited until this, will pay 12·18 (85·50—73·32) of surtax.

It was especially on these two latter surtaxes that discussion of the Central Committee turned. The second appears sufficient, but the first seems to be out of proportion with it, looking at the saccharine richness of *poudres blanches*.

As to the interior *régime*, the Committee decided to wait,—to rest in *statu quo*, without expressing views in favour of any system, but without at the same time ceasing to emphatically insist on the

reduction which would have, among other advantages, that of aiding the establishment of an interior *régime* acceptable by the majority of the *fabricants*.

The *Sucrierie Belge*, referring to the petition of the Belgian Association (see July *Sugar Cane*,) relative to the establishment of surtaxes, reciprocal to the French *régime*, says "that this petition " merits more than ever the notice of our Government, and especially the notice of the Minister of Finance."

Mr. Jacquemart, writing to the *Sucrierie Indigène*, says: "We " heard, at the International Congress of Agriculture, one of the " refiners' representatives, who cried: 'I protest against a confirmation of the report of the 7th section. In France, it is said " the bounties are given to the refiner.—No, and I have authority " to declare that the refiner in France does not receive any " bounty.'" In your issue of the 20th June there was a very able article, emanating, it seems, from another representative of the refiners, with the aim of showing that things are no better under the existing *régime*; that the State, it is true, in order to maintain this harmony, pays or leaves to the refiner a bounty of 3frs. the 100 kilos, but that this bounty is absolutely necessary to the refiner in order to sustain outside competition. In our view, neither the orator nor the writer state the truth. The International Congress has responded to the orator by unanimously voting the suppression of the bounties, and we even believe that the orator, carried away by the force of circumstances, joined his vote to that of the Assembly. We will not return to this subject, but rather take up the author of the article, who is also a friend of the refiners, and who has declared, as we have just read, that the refiners get 3frs. at least, per 100 kilos.

In the article the writer shows that the refiner has combined his operations with great intelligence, and that he pays the same price, or very nearly, for 100 degrees of sugar, no matter what class has produced this sugar. But, if it is evident from the invoice price that this is so, it does not say, and we do not wish to say that the refiner would make an equal profit on each of the different classes of sugar. The author leaves in the shade this side of the question,

so interesting, notwithstanding, to the *Sucrerie Indigène*. About two years ago an analogous paper was presented, in the name of the refiners, to the Superior Council of Commerce. This paper went to show that, with the aid of invoices and samples, accompanied by *certificats d'origine*, whatever the class of sugar might be, the refiner never bought it without leaving a standing reserve between the buying price and the price realised in refining. One of the members of the Superior Council showed them *that if the apparent reserve, thus stated, was always the same* the real benefit the refiner drew from the sugar (if account was taken of excessive yields and the exaggeration of the co-efficient 5) *would always be growing, and in a notable manner, according as the scale of classes descended*. This showing is equally applicable to the tables given by the writer above, we might say, with the member of the Superior Council, that if the refiner buys the 100 degrees of sugar at a uniform price, the lower the class the greater the benefit. Thus, not only has the refiner bounties, as the writer avowed, but their amount is far larger than he puts them at. From the tables given by the writer we are furnished with the proof that a fact, often affirmed by the refiners and accepted too easily by a part of the *fabricants*, *does not exist*. While the refiners *buy all the sugars at the same price per 100 degrees, they pay no more for sugars in 7/9 than in any other class; in consequence, the refiner does not divide the bounty with the fabricant, and the latter does not receive it from the refiner*.

We do not admit the necessity of a bounty for the French refiners because foreign sugars receive bounties. Before we are convinced of so singular a necessity, we must know in what market the foreign refiner can buy cheaper sugars than in ours.

In conclusion, we may say :—

1. The facts given by the author show that the refiner pays the same price per degree of sugar in every class, and, in consequence, that the *fabricant* receives no bounty.
2. The refiner receives bounties considerably higher than stated by the author.
3. These bounties are as hurtful to the native as to foreign manufacturers, and we emphatically demand their suppression.



The *Journal Officiel*, in its issue of the 17th, gives an account of the receipts for the first six months of 1878, compared, on the one side, with the Budget estimates, and on the other with the receipts for the same period of 1877. The following are the figures extracted from this table relative to sugar.—

	1878. Payments made.	1878. Budget Estimations.	1877. Payments made.
Customs Duty on the Importation of Sugars—Colonial .....	9,671,000 ..	11,886,000 ..	11,212,000
Foreign .....	19,584,000 ..	14,560,000 ..	23,731,000
<i>Fabrication</i> Duty on Sugars—			
<i>Indigène</i> .....	43,587,000 ..	54,913,000 ..	28,751,000
Total .....	<u>77,842,000</u>	<u>81,359,000</u>	<u>63,694,000</u>

The difference on the Budget estimations is as follows:—

	More.	Less.
<i>Sucres</i> —Colonial .....	....	2,215,000
Foreign .....	5,024,000	....
<i>Indigène</i> .....	....	6,328,000
	<u>5,024,000</u>	<u>8,541,000</u>
		5,024,000
		<u>3,517,000</u>
	Less ....	

Thus, the duty on sugars during the first six months of 1878 is 3,517,000 fr. under the Budget estimations. For the first quarter this deficit was 8,585,000 fr.; there has been, therefore, a very sensible amelioration. This amelioration is noticeable also if we compare the receipts of the six months of 1878 with the receipts of the same time of 1877; the augmentation is, in fact, 14,148,000 fr. in favour of 1878. This fact supports the reduction, because in 1877 sugar was scarce and dear, and to the burden of the duty was added that of dearness. As to the amelioration on the first quarter of 1878, it is incontestible that, on account of the Exposition, the consumption has very much increased. The arguments in favour of duty reduction are now become stale, everybody, very nearly, being convinced of its necessity.

*Die Deutsche Zuckerindustrie*, for the 26th July, gives some results of the growth of the beet-root in several of the German

departments. Among them we find the following given by Messrs. Jul: Schliephacke & Co., Minsleben. The figures are the average of 8 lots, from the 16th to 22nd July, temperature warm and dry. The weight of the roots was between 85 and 133 grms., that of the leaves 210 to 317 grms., the degree Brix of the pure juice  $13.2^{\circ}$  with 9.32 sugar, to  $14.5^{\circ}$  with 10.85 sugar, and a coefficient of  $70.5^{\circ}$  to  $75.4^{\circ}$ . In the same place, the mean results of the year 1877 were, at the same period—weight of roots, 79 grms; sugar in pure juice 8.94, so that this year's crop is likely to turn out very well. At the *fabrique* of Urisebourg, the weight of the roots was 250 grms., the leaves 500 grms.; degree Brix, from  $10.1^{\circ}$  to  $14.3^{\circ}$  with sugar from 6 to 10.3 and a coefficient of 60 to 72.

The advices from the principal sugar colonies are all very favourable. As regards Cuba, it is expected to yield 550,000,000 kilos., about 50,000,000 kilos. above that of last year.

The following is a general valuation, agreeing with that of M. Licht, of Magdebourg, as far as it relates to the continental production:—

	Tons Beetroot.	Tons Cane.	Total Tons.
1877-78 ....	1,395,000 ..	1,877,000 ..	3,272,000
1876-77 ....	1,101,157 ..	1,925,173 ..	3,026,330
1875-76 ....	1,372,329 ..	1,836,408 ..	3,208,728
1874-75 ....	1,184,048 ..	2,012,420 ..	3,196,468

The year 1877-78 has thus produced more sugar than the four preceding years, but the importations from the different colonies will leave a deficit, which will probably reduce the general total to about 3,200,000 tons, about the same as 1875-76, and 1874-75.

### MONTHLY LIST OF PATENTS.

Communicated by GEORGE DAVIES, C.E., Patent Agent, 4, St. Ann's Square, Manchester.

#### ENGLISH.

#### APPLICATIONS.

2884. JOHN BOWING, of 184, Gresham House, Old Broad Street, London. *Further Improvements in filter-presses, founded on those described in*

*the specification of former Letters Patent granted to me and dated 10th February, 1877.*

3043. JAMES DUNCAN and JOHN ALEXANDER REINA NEWLANDS, both of Mincing Lane, London, and BENJAMIN EDWARD REINA NEWLANDS, of East Ham, Essex. *Improvements in the treatment of sugar.*

3049. J. DUNCAN and J. A. R. NEWLANDS, both of Mincing Lane, London, and B. E. R. NEWLANDS, of East Ham, Essex. *Improvements in the treatment of saccharine substances or compounds.*

3169. JOHN SCHWARTZ, of Pelham Street, Stepney, Middlesex. *Improvements in the manufacture of sugar.*

3252. ASTLEY PASTON PRICE, 47, Lincoln's Inn Fields, Middlesex. *Improvements in the preparation and treatment of saccharine substances and compounds.* (A communication from M. Weinrich, of Vienna.)

#### ABRIDGEMENTS.

4647-77. CHARLES DENTON AREL, of Southampton Buildings, Middlesex. *Improvements in the manufacture of lump or loaf sugar, and in apparatus employed therefor.* (A communication from E. Langen, of Cologne, Germany.)

This invention consists in charging a number of open-ended moulds with syrup, securing them one above or against the other, with perforated plates between them, the perforations allowing the syrup to run from the one mould into the other, while the sugar in the perforations, when set can readily be broken, by introducing between the moulds a lever which separates them one from the other. The moulds together with their plates are then placed in a centrifugal machine which drives out the green syrup contained in the sugar through the perforations in the plates and from thence through the sides of the centrifugal machine. The moulds are then placed on a liquoring table and if after the liquoring process any green syrup still remains in the moulds they are again submitted to the action of the centrifugal machine. The division plates separating the sugar slabs in the moulds are then withdrawn, and the moulds are placed on a drying table, consisting of a chamber containing heating pipes enclosed at top by a plate, having apertures over which the sugar moulds are placed, and having at bottom a perforated plate through which air is forced in divided streams, so as to become uniformly heated. The air passes through the spaces between the slabs, which are thus quickly dried.

4864. JOHN NEALE, of 47, Lincoln's Inn Fields, Middlesex. *Improvements in moulding and compressing granular sugar, and in the machinery or apparatus employed therein.* (A communication from A. F. W. Partz, of Philadelphia, United States of America.) The sugar is moulded and compressed on metal plates smooth on the upper surface and provided with ribs beneath. By means of suitable catch levers seizing these ribs the plates are moved for-

ward through the machine. The plate passes first beneath a box into which is fed the granular sugar, which is evenly distributed by means of a revolving cylinder as the plate passes onwards; the sugar is then carried to the moulds. These are formed by knives intersecting each other and are caused by an arrangement of cams to fall and divide the sugar. Pistons shaped to fit each compartment formed by the intersecting knives are then arranged to descend into these spaces and compress the sugar. The moulds and pistons are then fitted up by the cams and the moulded and compressed sugar is pushed onwards and a new supply of granular sugar furnished to the moulds by the action of the catch levers and the ribs beneath the plate. A revolving cylinder, inside the hopper or box before mentioned, and furnished with four or more rows of teeth, breaks up any lumps in the sugar.

## BELGIAN.

- 45,605. A. ZENISEK and C. SCHMIDT. *Extracting sugar from its residues.*  
 45,638. P. H. and L. J. MASSIGNON. *Preserving the sugar contained in beet-pulp by drying.*  
 45,646. L. DERVAUX-IBLEA. *A process of selecting beetroot for producing seed and for preserving its yield of sugar.*  
 45,674. W. FREAKLEY. *Improvements in filter-presses.*

## FRENCH.

- 121,932. N. and J. BLOCH. *A system of storing, removing, and washing beetroot, potatoes, coals, coke, and other substances.*  
 121,953. BACHET, of Paris. *Saccharifying amylaceous or feculent substances by water, heat, and gluten.*  
 122,111. PARTZ. *A machine for moulding sugar.*  
 122,113. LECHATONNIER, of Amiens. *Refining sugar in sugar mills.*

## CERTIFICATES OF ADDITION.

- 115,515. BONZEL. *Improvements in his press for extracting beet-juice.*  
 114,601. LAMBERT. *The application of compressed air to the manufacture of sugar.*  
 118,480. LOEWIG. *A process for clarifying cane-juice.*  
 120,491. DERVAUX-IBLEA. *Evaporating osmose-juice and water and utilizing the waste steam.*

## GERMAN.

1774. T. SCHREIBER, of Paris. *A continuous kiln for animal charcoal, with plain or corrugated retorts, coated with a fire-proof material.*  
 1637. F. M. BACHET and F. D. SAVALLE, of Paris. *A process for converting fecula into dextrine or grape-sugar by the action of carbonic acid.*  
 1868. A. MARTIKKE, of Schönebeck-on-the-Elbe. *Press-sieves of cane for sugar works, &c.*  
 1914. R. PZILLAS, of Brieg. *A spreader and scraper for sugar-presses.*

1950. DUNCAN and NEWLAND. *Purifying sacchariferous liquids (syrup) by means of sulphate of alumina.*

1964. F. DIPPE, of Schladen. *A continuous centrifugal machine for draining cut beet-root.*

1973. H. PRIEW, of Bernburg. *A hot process and apparatus for claying sugar in the centrifugal engine.*

2008. \*SELWIG and LANGE, of Brunswick. *A simplified valve armature for diffusion batteries of sugar works and for similar lixiviators.*

2220. E. LANGEN, of Cologne. *Manufacturing refined sugar by means of a centrifugal machine.*

#### AMERICAN.

203,556. WILLIAM T. PHEGLEY, of Bloomfield, Indiana. *Improvements in evaporating pans.*

The pan consists of two parallel side bars and a series of intermediate metal sheets, each having two flanges, one of which is folded over the adjacent flange of the next sheet, the other flange of the latter being folded over the adjacent flange of another sheet, and so on. The edges of these metal sheets are inserted in recesses in the side bars which are then firmly bolted together by a screw-bolt at each end of the structure thus formed. The flanges divide the pan into compartments which are made to communicate through opening leading to recesses or passages formed in the side bars, the openings of adjacent compartments being in the same bar on opposite sides of the flanges. If it is desired to cut off the communication between any two pans, a stop is inserted in the openings. The juice passing from one pan to another is freed from the scum and passes into each pan cleanly skimmed.

#### SUGAR STATISTICS—GREAT BRITAIN.

To AUG 17TH, 1878 AND 1877. IN THOUSANDS OF TONS, TO  
THE NEAREST THOUSAND.

	STOCKS.		IMPORTS.		DELIVERIES.	
	1878.	1877.	1878.	1877.	1878.	1877.
London . . . .	79	94	175	204	192	162
Liverpool ..	38	37	133	141	126	121
Bristol . . . .	4	3	31	29	29	29
Clyde . . . . .	64	44	180	170	155	143
Total ..	185	178	519	544	502	455
	Increase.. 7		Decrease.. 25		Increase.. 47	

STOCKS OF SUGAR IN THE CHIEF MARKETS OF THE WORLD ON THE  
1ST JULY, FOR THREE YEARS, IN THOUSANDS OF  
TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
188	85	35	15	4	327	306	350

CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING  
1ST JULY, IN THOUSANDS OF TONS.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
901	272	26	283	178	1660	1554	1637

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE,  
FOR THE ENSUING SEASON, COMPARED WITH THAT OF THE THREE  
PREVIOUS SEASONS.

(From *Licht's Monthly Circular*.)

	1877-78.	1876-77.	1875-76.	1874-75.
	Tons.	Tons.	Tons.	Tons.
France .....	385,000	243,295	462,259	450,877
Germany (Zollverein) ..	370,000	291,204	346,646	250,708
Austro-Hungary ....	330,000	247,175	208,912	158,884
Russia and Poland ..	220,000	250,000	245,000	222,500
Belgium .....	65,000	44,467	79,796	71,079
Holland and other Countries.....	25,000	25,000	30,000	30,000
Total.....	1,395,000	1,101,141	1,372,613	1,184,048

## STATE AND PROSPECTS OF THE SUGAR MARKET.

Prices of raw sugar are about on a par with our quotations last month, with the exception of Paris loaves, which are 6d. cheaper.

Crushed sugar has declined also in consequence—the rise or fall in price of Paris loaves being the key to prices in England.

A great change has taken place in the relative position of stocks in 1877 and 1878 towards each other, the excess of stocks on the 20th July last, over those at the same time in 1877, of 24,500 tons, was on the 17th August reduced to an excess of about 6,800 tons.

The London Commercial Report, however, at that date, made the excess 9,870 tons, and on the 24th August 15,709 tons.

This change in the relative position of stocks has no doubt had its influence in withstanding the natural result of a fall in the price of French loaves; and holders of raw sugar have managed to hold their own. But either refined sugar must improve in price or raw must give way—and which is to be the solution it is impossible to say.

The latest report in face of less stocks is, “Foreign loaves again 3d. lower.”

Raw sugar cannot resist this, whatever the statistics may for the moment. Planters the world over are in the hands of the Paris refiners. The Paris refiners have the means afforded them to sell refined at less money than it costs to refine it, and to force planters to do the same or cease planting.

It is of course their interest to get as much money as they can for their produce; but excessive bounties have produced excessive supplies, and that, without affecting the injury done by the bounties, forces them to undersell each other. In time we have all the disadvantages and ruin of the bounty system, and the benefits of it secured by no one. And yet there are people who are supposed to be political economists who think the consumer is benefited by such absurdities of legislation as are involved in the system which gives bounties to exporters of sugar.

And the reason they give is that it is right that we should get our sugar from the countries which “naturally” can supply it to us at the lowest prices—a proposition not denied by sugar refiners, who, however, dispute the title of such a method of supplying it to being “natural.”

Present quotations of the standard qualities are as under:—  
Porto-Rico fair to good refining, 21s. to 22s., against 21s. to 22s.; good to fine grocery, 23s. to 25s., against 23s. to 25s.; Martinique crystals, 27s. to 27. 6d., against 27s. to 27s. 6d.; No. 12 Havana, 23s. to 23s. 6d., against 23s. to 23s. 6d.; fair to good refining Cuba Muscovados, 21s. to 21s. 6d., against 21s. to 21s. 6d.; middling to good brown Bahia, 18s. 6d. to 19s., against 18s. 6d. to 19s.; good to fine Pernambuco, 19s. to 20s., against 19s. to 20s.; Paris loaves, 27s. 9d. to 28s. 6d., against 28s. 3d. to 29s.

# THE SUGAR CANE.


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 The writers alone are responsible for their statements.

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## THE SUGAR TRADE OF CANADA.

An annual report on the home and foreign trade of Canada, very ably drawn up by Mr. W. J. Patterson, gives some interesting statistics respecting sugar. It appears that of all the goods paying specific duties imported from Great Britain sugar is taken in the largest quantities. The same is the case with the imports from the United States and other countries; but while the value of the sugar imported from Great Britain, in 1877, amounted to 2,590,365 dollars, that from the United States amounted only to 2,048,828 dollars, and that from other countries to 615,972 dollars. The value of sugars from Great Britain had increased 1,138,951 dollars as compared with the previous year, and 1,249,143 dollars as compared with 1873.

The total imports of sugar into Canada in 1877 amounted to 97,104,336 lbs., of which 50,751,240 lbs. came from Great Britain, and 31,351,939 lbs. from the United States. The imports from Great Britain constituted 52·73 per cent. of the total consumption in 1877, 29·11 per cent. in 1876, and 32·31 in 1875. Those from the United States were 32·79 per cent. of the total consumption in 1877, 38·43 per cent. in 1876, and 23·79 in 1875. The increase in the imports from the United States in 1876 was no doubt due to the export bounty then established on American refined sugar. The increase in the importation of British sugar may be partially ascribed to the increasing favour shown in Canada to low priced yellows from our refineries. In contrast with this increase in the consumption of



British and American refined sugars, we find that while the quantities from countries of growth amounted to 43·55 per cent. of the total consumption in 1875, they had decreased, in 1877, to 14·4 per cent. Here is a complete illustration of what the sugar refiners and West India merchants contend will take place in this country if our government permit foreign export bounties to continue unchecked. In 1875, the United States established an export bounty and thus made refined sugar abnormally cheap. The result is that sugar refining in Canada has ceased to exist. In 1875 Canada imported over 45,000,000 lbs. from countries of growth. Now she imports less than 15,000,000 lbs. from those sources. In the meantime the United States Government changes its mind, reduces so as almost to abolish the bounty, prohibits the introduction of artificially coloured raw sugar, takes steps to modify its method of assessment and institutes a stringent enquiry into alleged extensive frauds on the revenue by its refiners. Canada is therefore left in the position of being, on the one hand, destitute of a refining industry, and, on the other, suddenly deprived of the artificial supply of bounty fed sugar from its neighbour. It has, therefore, been compelled, at great economical sacrifice, to draw its supplies from the refineries in this country. It is an ill wind that blows nobody good, and the benefit to our refiners may be appreciated from the fact that out of a total export of British refined sugar of 56,000 tons, in 1877, 22,600 tons went to Canada. It is evident that our refiners must beware of regarding this as a permanent outlet for their sugars, and it is more than probable that an end will very shortly be put to this abnormal export trade. On the one hand the United States Government have considerably reduced their export bounty; on the other, the recent elections in Canada indicate the speedy approach of a more protective policy in that country, which will probably enable the Canadian refiners to resume operations and will shut out British and American refined sugars.

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A visitor to Natal, after making a tour of the coast, asks us how it is that wherever he goes he finds planters burning, and so destroying, trash, weeds, and other vegetable clearances, instead of preserving, or, to speak more correctly, decomposing such matter in pits, utilising the compost and restoring it to the soil as manure, its value in such form being undoubtedly great.—*Queenslander*.

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THE FOREIGN SUGAR BOUNTY SYSTEM.

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LARGE MEETING AT BRISTOL.

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Last night, a meeting was held in the large Colston-hall to protest against the maintenance of the foreign sugar bounties. There was a very large attendance. The Right Worshipful the Mayor (Mr. G. W. Edwards) presided, and amongst those on the platform were Messrs. J. Evans, C. J. C. Pritchard, G. de Lisle Bush, U. Alsop, W. Polglase, E. G. Clarke, H. Chamberlain, F. F. Fox, H. H. J. Spear, J. D. Whereat, R. C. Stephens, R. H. Wilson, C. Fox, A. Temple, J. Hodge, R. Hunt, L. Waterman, E. Naish, C. E. Lucy, G. H. Brown (Plymouth), Nicholson (Plymouth), C. F. Hare, S. Peters, Captain Peake, C. H. Macfarlane, and delegates from the sugar refinery operatives of Greenock, Glasgow, Liverpool, London, and Edinburgh.

The Mayor, who was received with applause, expressed the great pleasure he felt in being allowed to take part in that meeting, which was called to redress what he could not but consider a great injustice towards a large and important body of British operatives, and also those who had invested their capital in the important business of sugar refining—a trade for which England had always been celebrated, and their own city had held a foremost place (hear, hear). They would allow him, perhaps, to speak of a personal matter for a moment. They were aware that the large refinery at Countership—which, being unfortunately somewhat overweighted, had been closed during the past year—had some great chance, he trusted, of being shortly re-opened under different management and different arrangements (applause). When he told them that he had himself something to do with that matter it might be said that he was there advocating his own interests, but his opinion of the injustice of foreign sugar bounties had been long formed, and he had ventured to express that opinion publicly on two occasions when he had the honour of presiding at the meetings of the Chamber of Commerce in the past and present years (hear). Although he would not object to receive a good dividend on any small investments he might have in

the new concern, his principal wish was that a large concern now lying dead in the heart of this city should be again opened, again producing sustenance for those who formerly worked there (applause). A great opposition was being made to the movement which they were at present advocating, because it was considered an opposition to free trade, and he was afraid that there was a great deal of political matter imported into the question; but free trade ought not to be a part of politics at all. They must remember that it was opposed by Liberals and Conservatives alike. The late Earl Russell, they must all have heard, wrote a pamphlet in favour of the corn laws; that Lord Melbourne said it would be madness to repeal the corn laws, and they all knew that Sir Robert Peel was instrumental in their repeal (hear, hear). But what was free trade. He held it to be simply this, that where an article was produced in one country, and could be brought to another at a cheaper rate than it could be produced in that country, that in itself was a great benefit, and should be accepted as such, and they would be wrong if they took any means to protect home producers of manufactured articles under like conditions (hear, hear). He was glad to find that those opinions were held universally throughout England by all parties. They could only hope that their friends across the channel, and their brethren across the Atlantic were equally educated. But when a foreign Government stepped in, and by subsidising a particular manufacture, enabled it to interfere and do its best to ruin a similar manufacture in another country, he could not see that there was any freedom in that trade at all (applause). It might be called protection, but it was unjust to the people of the country in which such a system was fostered, as it benefited only a few by laying a tax on the many, and it was the grossest injustice to the country interfered with in such a manner (hear, hear). The only means of meeting such an injustice was total prohibition—that was, not to receive the subsidised article in the country at all—or they should put on such a duty as would equal the bounty given by the foreign country (applause). He thought there was no treaty at all which would prevent a country taking such a course, but he was of opinion it

would be an interference with free trade to resort to such a course, and at present, at any rate, he was not favourable to the adoption of such a measure (applause). He trusted that movement would continue, and that the result of it would be to carry out the object they were then met to forward (applause).

Mr. S. PETERS (Secretary of the Sugar Operatives' Association) read letters which he had received from gentlemen who were unable to attend. Mr. K. D. Hodgson, M.P., said he fully sympathised with the objects of the meeting, which his health would not allow him to attend personally; but he wished the promoters the greatest success. Mr. S. Morley, M.P., regretted that he should be in Scotland when the meeting took place. He wanted a little relaxation, but he wished the meeting to be a great success, and he also wished success to the object the promoters had in view. Mr. W. K. Wait, M.P., hoped the meeting would prove to the foreign statesmen the suicidal policy that they pursued, and the injustice that they did to this country. Mr. Sampson Lloyd, M.P., thoroughly sympathised with the objections of the promoters of the gathering to the cruel and unjust position in which the Bristol sugar trade was placed, and he should not be backward when he was able to state that conviction in public or private. Letters had also been received from Mr. Ritchie and several other members of the House of Commons, expressing sympathy with the objects of the meeting.

The Mayor stated that he had likewise received letters from the High Sheriff (Mr. W. H. Wills) and Mr. W. Lee, wishing the movement to remove the unfair competition of the continental refineries every success. He had also received a rather long letter from Mr. W. Pethick, which he would read to the meeting:—

“30, Queen Square, Bristol, September 6th, 1878.

“*To the Right Worshipful the Mayor of Bristol, Chairman of the Meeting at Colston Hall, September 9th, 1878.*

“My Dear Sir,—I am sorry that a previous engagement out of Bristol will prevent my attending the meeting on Monday for the purpose of protesting against the iniquitous system of bounties, which is injuring the sugar refiners of this country, and which is causing such disastrous consequences to the trade of Bristol.

“I would gladly have raised my voice against it, and have joined in seeking a remedy, and, as an earnest free trader, would strive to prevent the diversion of the natural course of trade by any artificial legislative interference.

“I believe most entirely in the maxim of the ‘greatest good to the greatest number’ as a sound basis of statesmanship, and I think the claim of British citizens to the defence of their persons and property from injury is one of the main objects for which Government exists.

"Applying these principles to the case in question it is undeniable :—

"1st. That the natural course of trade is diverted by this bounty system.

"2nd. That the 'greatest good to the greatest number' is not promoted by the benefit procured for the consumers of sugar, only, after all, one (large) class of the community.

"3rd. That the ruin of the sugar manufacture in this country, caused by the bounty system, is a direct damage inflicted by a foreign Government, and is, therefore, within the category of those injuries from which Government is designed to protect its private citizens.

"I am astonished that the genius of free trade should be invoked in defence of a system which violates the freedom or natural course of trade, and that any objection should be raised to transfer the benefit thus wickedly and wantonly offered to one class of the community—to the use of the whole nation—by levying an equivalent duty on the import thus stimulated by foreign Governments to the direct injury of another class of citizens.

"If a few English steamers were boarded, and the cargoes plundered by any foreign cruisers, it would undoubtedly be the duty of our Government to insist on reparation and restitution. Although only a small class of the community would have suffered, yet the whole nation would deliberately encounter the cost of sustaining, *vi et armis*, the rights of the injured portion.

"Much more, therefore, should our Government now, after having exhausted every form of persuasion and remonstrance, appropriate to the National Exchequer the amount which foreigners are willing to pay as a means of destroying our manufactures.

"I believe no longer in protests, but in action; and ten minutes in the House of Commons on the proposal of a corresponding duty on the import, on the occasion of the next Budget, will be a more graceful tribute to free trade, a more real vindication of the policy of the statesman who promotes the 'greatest good of the greatest number,' and a more effectual defence of private rights against foreign Government aggression than all the papers, protocols, and conventions that have been going on for many years with the only result of leaving the foreigners laughing in their sleeves at the honesty and good faith of Englishmen.

"I remain, dear Sir, yours very truly,

"WILLIAM PETHICK."

Mr. RICHARD HUNT (President of the Coopers' Society) moved—"That in the opinion of this meeting the doctrines of free trade require that all competition should proceed upon the basis of relative natural advantages, thereby securing to consumers the lowest natural price approximating to the lowest cost of production. But the bounties given or obtained on exports of raw beet or refined sugar to this country from France, Holland, Belgium, Austria, Germany, and Russia, operate upon the English sugar

market so as to prevent competition on the free trade basis of natural advantages, and thereby deprive English producers of their right to free trade competition in their own markets, inflicting upon them the necessity of withdrawing from the unjust competition, or of giving out of their own profits and wages an equivalent of the foreign bounty." He said it was well known to them all that a large section of the working population of their own, in this city, had suffered from the unjust operation of the sugar bounty system. Solely in consequence of the operation of this system no less than fifty or sixty sugar refineries throughout the country had been closed, and it was only a question of time for the few existing refineries to share the same fate if this system was allowed to go unchecked. At present the French producers were laughing in our faces at their being able to beat the English manufacturers in their own market. If the present system was allowed to go on, they would have to pay more in the long run for sugar, because when the foreign exporters found that they had beaten the home producers out of the market, they would increase the price to just what they liked. He warned his hearers earnestly that if they did not resist and do their utmost to get this odious system abolished, it would be extended, by and by, to their other industries. Belgium would be subsidising the iron exports, and the same state of things would be brought about in the English iron trade as now existed in the sugar trade. He was indeed glad to hear from their chairman that it was likely that the Counterslip refinery would be opened again (cheers). When the doors of that great concern were closed a vast number of honest, hard-working men were thrown out of employment. He might tell them that something like 100 coopers were engaged in Bristol a few years ago—before the bounty system operated so seriously against the British refiners—in making casks for the West India sugar trade; but to-day the whole number of coopers required annually to do the work for the West Indian colonies would be about six or seven (cries of "Shame"). That falling off in the employment of coopers was not confined to Bristol, but a similar state of things existed in Liverpool, Glasgow, Greenock, Leith, and various other places. He implored his hearers to do what their fellow-workmen had done in Greenock, Glasgow, and London during the past two months, and to lift up their voices in honest protest against one of the greatest blots that ever disgraced the records of Europe (loud cheers).

Mr. J. Hodge seconded the motion, because he believed if there was one question which more than another required the immediate attention of Parliament, it was the subject of the foreign sugar bounties, for he considered that unless the Government interfered we should lose the sugar-refining trade altogether. The only way to alter the present state of things was to try to persuade the French Government to collect the duties in another

manner, or, in other words, to refine in bond. They had been unable to get a satisfactory answer from the French Government, or at least the French Government had not acted up to their promises. They had made the excuse that if they were to refine in bond they would lose 10 or 15 per cent., and they could not do that. The fact was that they did not know what to do, because they knew if they adopted any system which would abolish the bounties it would curtail their exports at once, and they accordingly dilly-dallied with the matter. If some change were not made the English manufactories would be closed, and we should only have French sugars in the market. Our trade with the West Indies was injuriously affected by the maintenance of the bounty system; and they had only to look at their own city to see the evil effects of it in the shutting up of a large and once flourishing manufactory, and he believed, unless an alteration was made, things would be much worse than they were at present. The reason the Government did not deal with this question was that no pressure had been brought to bear upon them. It was no matter that they knew a grievance existed: they would do nothing unless Parliament was inundated with petitions, unless public meetings were held all over the country, and unless the people were continually sending copies of resolutions and agitating the question. When the Government saw that the public was thoroughly aroused then they took measures to remedy the grievance. The Government knew that a grievance existed with regard to the sugar bounties, and they must be made to understand that it could and must be got rid of. They had heard a great deal about the "spirited foreign policy" of the Government, but he really failed to see that they had displayed much spirit when they had allowed one of our industries to fall away from us, as our sugar-refining trade was doing. In conclusion, he urged his hearers to take up the question, and to agitate for an alteration in the sugar bounties, warning them that unless they did so they would not obtain redress.

Mr. C. F. HARE supported the resolution, and remarked that the Mayor had touched on one point which he thought they should lay well to heart, and that was how important it was to maintain the manufactures of this country (hear, hear). For the prosperity of a country it is necessary that it should be one of three things; it must either be a producer of precious metals, such as gold and silver, a producer of corn and raw materials, or it must be a manufacturing country. England was entirely a manufacturing country; we had the sinews of manufacture, iron and coal, in abundance, and it was therefore necessary they should adopt the utmost means in their power to take care that no manufacture left the country (cheers). At the present time, by the supineness of the Government, who let things stay as they were simply because we had been prosperous in the past, we had been allowed to drift into a state of trade which was most

depressing, to say the least of it. That state of things must come to an end before long, but the people must put their shoulders to the wheel to try to bring it to an end (cheers). The foreign Governments should not be allowed to give bounties, and the people of England must stand up as a nation and say they would not have it, and the Government must work in their interests as manufacturers. He supported the resolution with the utmost warmth, knowing that if Englishmen came forward with vigour and determination the Government must give way (cheers).

Mr. J. McALLEN, a delegate from Greenock, further supported the resolution, and said out of the fourteen sugar refineries in Greenock four had been closed, and one in Leith and another in Dublin, in each of which only Greenock men were employed, had been shut up. The men engaged in those manufactories had been thrown out of employment, and they were walking about the streets starving; and their wretched condition was owing to the odious bounty system (cries of "Shame"). It might be asked how was it that the coopers were taking such a great interest in this question, and his reply was that their trade was at stake. He represented 700 coopers who in one way or another were suffering through the foreign sugar bounty system. One master who had once 100 men engaged on West India work now only had two employed, and another had only ten men where he used to have 150 in his service. He was glad the working men of Bristol had taken up the question, and he appealed to them to help in bringing about an alteration in the bounty system.

The resolution was carried unanimously.

Mr. PETERS, secretary of the Sugar Operatives' Society, proposed the following resolution:—"That diplomacy and treaty engagements having failed to stop these export bounties, it is the opinion of this meeting that it would be quite consistent with every principle of free trade, to restore free-trade competition to the English market, and to intercept, for the revenue, the foreign bounties, by levying against all raw and refined sugar exported to this country under such bounties a duty equivalent to the same. Provided that such duty be at once taken off as against any country abolishing bounties to the satisfaction of Her Majesty's Government." He said there were only three ways of meeting a bounty given on an exported article by a foreign nation, by the country which suffered from its effects: first, by the Government of that country giving bounties to that particular branch of industry; secondly, by putting a countervailing duty on the article imported, or thirdly, by retiring altogether from the competition (hear, hear). One class of industry, he contended, ought not to suffer that the consumers might obtain an article below its natural price (applause). He quoted statistics to show how the West Indian Islands had been affected by the unfair system of bounty protected sugar, and after pointing out that half the



amount of sugar produced in the world came from the continent, and directing attention to the artificial basis on which that trade rested, said a trade so bolstered up must in the end collapse (hear, hear). If England and its colonies retired from the competition, the export bounty would be immediately withheld by the continental countries which now adopted that system, and beetroot would cease to be grown because it would be no longer profitable, and there would be a dearth of sugar (hear, hear). That he thought showed that the question was one affecting alike the interests of the consumer and producer (hear, hear). Speaking of the manner in which the sugar bounty system had affected the sugar industry of the city, the speaker observed that if one trade suffered in this country it must indirectly affect all other trades. Directing attention to the large number of manufactures taken from this country by the West Indian colonies, he showed that if the sugar bounty system ruined their trade it would deprive them of those orders, and thus would affect in a material degree other branches of industry. In conclusion, he contended that the Government of the country ought to look to it and see that one of the important industries of England was not, in so surreptitious a manner, taken from them (applause).

Mr. J. EVANS, ex-president of the Chamber of Commerce, seconded the resolution, and said, as one of those who considered free trade a great blessing to the world, he hoped the day was not far distant when other nations would give up the protective system and learn wisdom from England in regard to those matters (applause). He had a great weakness for speaking of things precisely as they were, and of calling a spade a spade, and when he looked at the bounty system he could not but regard it as a most scandalous system, and a system which they should put their foot upon and determine should not exist any longer, for it rested like a hideous nightmare on British industry, giving no return for the investment of British capital, and rendering desolate the houses of British workmen engaged in a particular branch of industry, and no language could be too strong to denounce the iniquitous system which they had met that night to protest against (applause.) If it had been a question of superior skill on the part of their continental neighbours, or if they possessed superior advantages, then they might have submitted; but it was not so. Their manufactures were brought into unfair competition by means of the bounty given by the Government of their country (hear, hear). Diplomacy had failed to remedy the injustice: conventions had been entered into, and had been disregarded; and the only effective way of counteracting the iniquitous system was to impose a counteracting duty equivalent to the amount of the bounty (applause). He believed that if the country united in saying the injustice should no longer exist, and they made that feeling heard, it would be swept away (applause).

Mr. GEORGE DE LISLE BUSH, the President of the Chamber of Commerce,

who was received with loud cheers, supported the resolution, and said it was with considerable pleasure that he had listened to the very able speeches that had been made that evening, and that pleasure was considerably enhanced when he saw so many working men taking such an interest in the question—a question which he maintained was of the utmost importance, not only to them individually, but collectively. He saw many faces around him that he had been in the habit of employing—but work of late had been very slack, and it gave him pleasure to see that they were present to protest against this foreign bounty system, which had not only deprived them of labour, but had closed up the manufactories. It behoved them, one and all, to strive with the Government of this country to take up the question (applause). As President of the Chamber of Commerce, he might say that it came before that body some months ago, and they carried a resolution petitioning the Government to take up the matter. He was thankful to say they had received answers both from the Home and Foreign Offices, which led them to believe that the petition had been productive of some good. It now depended upon the working classes of the country to help in carrying the point. As Bristolians they felt the effects of the sugar bounty system as much, if not more, than any other city in the kingdom. He would say that if this pernicious system was permitted to go on, in a few years the sugar industries of the country would be entirely swamped. When this was accomplished, what would the foreign sugar-producing countries do? They would put up the prices, and the last phase of the trade would be worse than the first. He quite agreed with the remarks of the previous speaker about the injury which was also being inflicted upon our Colonies. A great trade was done between the West Indian Colonies and the city of Bristol, but owing to the existing state of things the amount of exports had fallen off more than one-half.

Mr. CHARLES FOX (treasurer of the Sugar Operatives' Association) proposed that copies of the foregoing resolutions should be forwarded to the Chancellor of the Exchequer and the Finance Ministers of all bounty-giving countries.

Mr. JONES, a delegate from London, in seconding the resolution, said the operation of the sugar bounty system had thrown one-third of the coopers employed in the West India trade out of employment, and had it not been for the funds of their trades-union they would have been pauperised in consequence of the commercial policy the country had adopted for the general good. He was of opinion that if the country adopted a commercial policy which caused a class of workmen to suffer, those workmen should not be allowed to become pauperised, but should be made state pensioners instead of parish paupers (cheers).

The resolution was agreed to *nem con.*

On the motion of Mr. S. PETERS, seconded by Mr. R. HUNT, a hearty vote of thanks was passed to the Mayor for his kindness in presiding.

His Worship briefly acknowledged the compliment, and the proceedings terminated.

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## TRIAL OF MR. W. EATHORNE GILL'S PROCESS FOR THE CLARIFICATION OF CANE-JUICE AT CANEFIELDS.

(From *The Barbados Globe*, of July 15th, 1878.)

Mr. President and Members of the Agricultural Society :—  
In response to your request that I would embody in a paper the results of my trials of Mr. Gill's process for the clarification of cane-juice without lime, I have now the honour of laying before you those results. The great speciality claimed by this gentleman for his process, is its power to arrest fermentation in the cane-juice, and to produce so thorough a clarification as to enable the planter to realise an increase of at least 25 per cent. in the sugar product. His mode of operating on the cane-juice is by means of galvanism, which he seeks to set up by the following method :—On the bed of the mill is laid a sheet of perforated zinc, the upper surface of which is thickly covered with a composition prepared by himself. From the bed of the mill the liquor is conveyed to a receiver by means of a wooden trough, the inside of which is covered with a coat of pitch. Along the bottom of this trough slips of perforated zinc are placed, touching each other at the ends. The upper sides of these zincs are likewise thickly covered with composition. The receiver into which the liquor is conveyed is a wooden tank 7 ft. long, 4 ft. 6 in. wide, and 4 ft. 6 in. deep or high. The inside of this tank is also covered with a coat of hot pitch. On the floor of this tank is placed a sheet of common zinc extending from the inlet to the outlet end, and at an equal distance from the two sides. Quartz sand is then placed in the bottom of the tank to the depth of 1 ft. Two *Separators*, an inner and an outer one, are next fixed in the tank, the same distance from either side of the tank as from the inlet end.

The outsides of these *Separators* are also thickly smeared with composition to blackness. The juice is received from the mill into

the inner *Separator*, and escapes thence by the opening provided below the outer *Separator*, and then ascends through the surrounding sand. Two diaphragms or strainers are also placed in the tank, 1 ft. 6 in. from outlet end and from each other. The arrangements for grinding operations to commence are now complete.

I may observe, in passing, that the utmost care was observed in the fitting up of the apparatus, everything being done under the supervision of D. M. Simpson, the engineer. My first trial of Mr. Gill's process was on the 6th March of the present year. Not having commenced to grind till three p.m., we only filled two Clarifiers (500 gals. each) and the Receiver, which holds about 700 gals. The liquor in the Clarifiers was subjected to 190° of heat, which caused a quantity of black scum to rise. The liquor was then tested with the litmus paper, which was turned a faint rose colour, and accordingly no lime was added. Thus far success seemed to be indicated. As it was too late to commence boiling that evening, the liquor in the clarifiers was allowed to remain till six o'clock next morning. On letting down the liquor into the taylor's, and again testing it, a slight acidity was perceptible, and the sugar made from this liquor was, although clear, very weak, and of scarcely any grain at all, and by no means to be compared with the sugar usually made on this estate. Now I mentioned that the Receiver was, on the evening of the 6th, left full of liquor. This was done in accordance with the advice given by Mr. Gill in his "instructions," wherein he states, in the most positive manner, that the liquor might be so left without any fear of acidity. My credulity was rewarded by finding this liquor, on the following morning, as acid as vinegar: scarcely any sugar could be obtained from it, even by a plentiful application of lime. The canes selected for the trial were of a very superior description, and the density of the juice was 10° Baumé. On the 8th, having carefully washed the mill and "*Separators*," as directed, and having made a liberal application of the composition, we again commenced grinding. On this occasion, we filled three clarifiers, and boiled off all the liquor the same day. On testing the liquor, after the scum had been removed, the litmus paper remained blue, so that about six pints of lime had to be added to bring the paper to a neutral tint. All three Clarifiers took about the same quantity of lime.

After being clarified, the liquor was let down into the tayches, boiled to a thin syrup and then sent to the Aspinwall pan, where it was gradually brought to a striking point by steam. From the pan it was drawn off into the oscillators (which are turned by steam) and, after being subjected to the usual amount of stirring, was finally discharged into the coolers. The quality of this sugar was better than that of the previous day, but far short of the usual oscillated sugar, and the quantity of crystallizable sugar obtained far less.

My third and last trial was on the 16th March, on which occasion several planters of experience and ability were present. Mr. Drumm (chemist) and Mr. J. R. Gaskin (a specialist in all matters relating to sugar-boiling) kindly gave me their valued services for this trial; and for a detailed account of it I must refer you to Mr. Drumm's letter on the subject, which will be found appended to this paper. The results of these trials have been duly communicated to Mr. Gill, and I shall be very pleased to lay his replies before the society. This gentleman, in his reply to my first communication, attributes the failure of his process to the composition not having been laid on sufficiently thick. To this I rejoined that it was simply impossible for it to be more thickly laid on than it had been. In his next letter he shifts his ground, and attributes it to the cane-juice being too pure. In his last communication he returns to the composition, which he thinks must have been too hard, and which he says should be sufficiently mellow "that when cold it shall soil the finger when touched." Whatever may be the cause of Mr. Gill's process not acting, I am unable to attribute it to the hardness of the composition, as, when applied, it was precisely of the consistency recommended by him.

It is much to be regretted that his process should have been attended with such unsatisfactory results, as it would have been a considerable gain to the planting interest if only a portion of the promises held out by him could have been realised. The trial of his process at Canefield was a fair and impartial one, and the result a wretched failure, causing loss of money, loss of time, and loss of sugar.

(Signed) W. G. ELLIS.

*Canefield, July 1st, 1878.*

Reef Works, Barbados,

8th April, 1878.

W. G. ELLIS, Esq., M.C.P.

Dear Sir,

In reply, as to the trial of Mr. W. E. Gill's process for clarifying cane-juice, which I saw made at your property, Canefield Estate, on the 16th March, I have to state with regret that it did not succeed in any way. It did not at all prevent or decrease the acidity of the cane-juice. The canes were ripe, cut clean, and yielded fair clear juice, faintly acid as it came from the rollers on the mill bed, which, as well as the gutter from it to the filtering box, had the coated slips of zinc as directed. On reaching the filters it showed more acidity, and also more on its filling the box of 700 galls., and flowing out to the Clarifier. The density of the juice was about the same at the mill, and as it flowed from the filter box repeated trials with correct saccharometers only showed a variation of  $\frac{1}{2}$  degree Baumé, say  $9\frac{1}{2}$  increased to 10, which was not continuous, and therefore not dependent on the process of filtration. Although the filtered juice showed such acidity, yet its appearance was good, and we expected it to clarify well, but this it would not do. It was most carefully attended to with steam heat and skimming, throwing up scum after scum, but not getting clear and bright, while the acidity was increasing. Then when the surface of the full Clarifier was almost free of scum, lime was gradually added, with watching the test glass, and use of litmus paper until it was nearly neutral. Still the liquor thus limed and cracked had not the proper clear, clean look (not the water or candle bright appearance), and it continued to require skimming in all the tatches, did not boil as freely as the usual liquor, nor did it come to as good a grain as your previously or since made sugar. Some of the sugar so made is now before me. It is heavy, moist, small-grained, and gummy; its solution is acid, sour to the taste and smell, cloudy, with a large sediment. It is not a sugar to sell well, or at all fit for use, without refining. I am bound to say, having read over Mr. Gill's directions and patent, &c., before the trial, that as far as possible—in fact quite as fully as

Mr. Gill's advice and directions—this trial was fully and fairly carried out. The sand for the filter box was pure quartz, free of lime and iron; it was washed clean and dried in the sun; the zinc slips were coated with the black composition and laid continuous from the mill bed on to the filter box; the directions as to juice strainers and box, its divisions, depth of sand, &c., were fully carried out. The filtered liquor looked well, yet there was constant scum, and there was no brightness, or clarification of the liquor, until some lime was added, and acidity was not checked from the crushing of the cane to the finishing of the sugar. Of the quantity or per centage of sugar produced, I can say nothing, nor of the resulting molasses, for so it must be called in this case, it being dark, heavy, gummy, and acid (though I hold to and agree with Mr. Gill and others that the mother liquor or free syrup from 1st or 2nd crystallization of sugar should not go as molasses, and for so low a comparative price, yet without vacuum pan and centrifugal, it must be so, and dark mother liquor will always be molasses in these markets).

I regret, dear sir, that you are so much disappointed and feel sorry there should be such a failure to report to Mr. Gill. He has evidently expended care, time and study, on the subject, and is a free and able writer on sugar matters; yet it is so, and it is now only to go on steadily until the time comes to try again for "the successful clarification" we all want.

With respect, I remain,

Your obedient Servant,

(Signed.)

W. DRUMM.

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We forwarded a proof of the above to Mr. Gill in the interest of our readers, to afford that gentleman an opportunity for any explanation he might think desirable, and received the following in reply :—

I can fully appreciate the desire of the Editor of *Sugar Cane* to throw as much practical light as possible on every attempt to clarify the juice of the sugar cane, which at present is a subject engrossing the attention of planters. Mine is not the only effort

in this direction, and when the opportunity occurs to record results, it must be satisfactory to see what are those results. Mr. Ellis has recorded his results in the *Barbadoes Globe*, and now they are transferred to the pages of *The Sugar Cane*, and I am permitted to add some remarks, and am obliged.

There can be less need for an analysis of Mr. Ellis' ability to conduct us to a complete result, when he tells us that he added six pints of lime to the cane-juice that had passed through my process of clarification, "because the litmus-paper test remained blue." The acerb tone of his letter betrays the antagonistic spirit in which he conducted those experiments. There is not a continuous series of experiments, but they are occasional. The intervals afforded time enough for producing acidity, enough to mar the results, which is one of my great aims to avoid. At last, after pottering with a process which he did not appreciate, Mr. Ellis invites his friends to become witnesses of a degraded experiment, begun in acidity to end in failure. We have only to compare his first with his last experiment to understand that the process suffered in his hands.

Mr. Ellis tells us that he left the tank full of cane-juice which had been clarified and was free from acid, to find it so much vinegar in the morning, as he had a right to expect, seeing he did nothing to prevent it. I could have no right to infer that one who claimed so much experience could be ignorant of essentials, when any attempt to explain them might be an insult to his better understanding. Mr. Ellis, however, proves my case—that the cane-juice, which had been hours passing through my clarifying process, had been deprived of the common causes of fermentation without the opportunity to ferment. His thus clarified cane-juice was quite capable of so remaining under suitable circumstances, and, doubtless, it was able to rush into fermentation under suitable circumstances. It follows, that if those germs of fermentation were not within, they must have come from without, for clarification could not beget fermentation.

We happen to know, by analysis, that atoms of ferment are constantly floating in the atmosphere of every boiling-house,



but especially where the dust of dry begass—cellulose—has access. We also know, by experience, that there is no more fertile opportunity than cane-juice affords for fermentation. It is quite competent for Mr. Ellis to challenge those laws whenever so inclined without invoking my aid, or imputing failure to my process, for neither aspire to impossibilities.

Here the contents of the tank were left exposed to those atmospheric ferments, and they—so to speak—accepted the challenge, and availed themselves of the opportunity, where there was absolutely nothing to prevent them.

I may presume to hint here that this prevention is so simple as scarcely deserving the remark—that a thin film of oil floating on and covering the surface of the cane-juice can prevent those germs of ferment penetrating to act on the cane-juice beneath.

Mr. Ellis boiled the clarified cane-juice, and obtained sugar crystals without lime. He produced inferior crystals. In his hands this appears very likely to have been the case. We see him recording much, and he might have recorded more had it comported with his inclination. That clarified cane-juice had been deprived of those impurities which make up the list of molasses formers when lime is added, either as a supposed clarifier, or the corrector of acidity. Here, Mr. Ellis tells us, lime was not required, and therefore it was not added, which is an important fact and “indicative of success.” Now we find, in practice, that clarified cane-juice, being deprived of its gummy and albumenoid impurities, evaporates much quicker and at a lower temperature than where lime is added to dissolve and retain the impurities, to boil them together with the sugar as usual. Mr. Ellis appears to take no notice whatever of these interesting facts, and we are left to conclude that these things were left in the hands of the native sugar-boiler to treat this sugar as routine had taught him, that is, he continued to boil it the usual time, which here was overboiling, that is spoiling the sugar. In a word, the sugar should not boil as if urged by folly, causing the froth, which is sugar, to recklessly flow over the surrounding brickwork, one of the last rags of Jumbo’s

legacy. That is, supposing all the sugar is desired and of a good quality.

Whilst I have pen in hand, I may expose another "hitch," which, of course, my process was asserted to be the cause. Those who are familiar with this process know that I provide a "cush basket" to receive the impurities, precipitated by the "glow" of galvanism, begun in the mill, repeated in the trough from mill to tank, and completed in the separators, as a slimy mud instead of slimy molasses, together with the ponderables brought on by the cane-juice. Of course, this "cush basket" should be occasionally emptied of its contents. This emptying had been neglected, and the basket filled to overflowing. Those mud-like impurities came over the surface of the sand to choke it. As filtration was thus stopped, the cane-juice accumulated to the peril of the diaphragms, to break them down.

Again, the remedy for this immense disaster (?) is perfectly simple and efficient. The diaphragms are not fixtures; they can be raised out of the tank, to continue the work by subsidence, without interrupting the work one minute. Those mud-like impurities will, of course, go on accumulating on the sand at the bottom of the tank, and if too fine to be retained in the "cush basket" when raised, they can all be drawn off from time to time out of the tank into a subsider, through the bend and hose already provided. Of course, the clear portion in the subsider is as good as required. I shall not be surprised if this process of clarification be considered of quite as much importance and as deserving of watchful attention as the boiling, and deserving a steady man to be held responsible. The increased sugar-product will abundantly repay the expense of this precaution, with profit.

In conclusion, I have to thank Mr. Ellis for thus establishing, by repeating, the fact which I have frequently asserted: that lime—that molasses former—can be dispensed with in the manufacture of sugar, which costs the refiner so much to get out. Had that gentleman gone on with legitimate experiments, it was quite possible for him to prove also that there was no

molasses to rob him of sugar. I have no doubt he did his best, and am not disposed to complain; on the contrary, I beg to thank him for all the good he accomplished, simply hoping he may do better.

As to Mr. Drumm's letter, I am free to confess that at first sight it was a complete paradox. The cane-juice comes faintly acid from the "rollers," and on reaching the filters it showed more acidity, and also more on its filling the box of 700 gallons; flowing out to the clarifiers, the acidity was increasing. Then lime was added, and litmus-paper used, until the cane juice was nearly neutral, and did not boil as freely as the usual liquor. We now arrive at the result of all this confusion. The sugar is heavy, moist, small grained, and gummy; its solution is acid, sour to the taste and smell, cloudy, with a LARGE SEDIMENT. Mr. Drumm, being a chemist, might have done a great service to all interested in this question had he ascertained the nature of this "large sediment." It would have been a great boon had he discovered from whence it came, for it might have been THE CAUSE of Mr. Ellis' disappointment and of mine, and not ours only. It was "a sediment," yet did not remain in the tank. Was the tank already so full of sediment as to escape together with the cane-juice? It is quite possible for acidity to be engendered and lurking there, for throughout these experiments we see no record of any emptying of the "cush baskets," which I had provided to receive the ponderables which cane-juice might bring, and the organic impurities which the "glow" of galvanism precipitates in a state of slimy mud, instead of being boiled with sugar to become slimy molasses. Galvanism changes the character of these impurities, and *they can explain all that we see narrated.*

Assuming that this neglect of the "cush baskets" to have been the cause sought for, it may be due from me to suggest how such a difficulty can be easily overcome, even supposing the precipitated organic impurities to be too fine to be retained in the "cush basket" when raised. They can all be drawn off into a subsider by the bend and hose which I provide on all

occasions, and which Mr. Ellis might have used. Nothing should prevent the "cush-basket" being raised and emptied occasionally, as experience can suggest. Where a coarse-grain sand is used, these fine atoms of precipitated organic matter can filter *with* the juice; but where very fine sand is used, it is likely to get choked, and filtration impracticable. Then the diaphragms must be removed to work by subsidence in the tank, else the success of my process is perverted, by neglect, to become its misfortune.

W. EATHORNE GILL.

*South Hill Park, Hampstead.*

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#### SANTA CROIX CENTRAL FACTORY.

(Extracted from the *St. Croix Avis*.)

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At a special meeting of the Colonial Council, on Monday, June 24th, convened at the request of His Excellency Governor Garde, there were present Rosenstand, Faber, Brown, Branch, Latimer, Elliott, Moore, Kalmer, Skeoch, and Hvid.

The Governor explained the object of the meeting, viz., to propose to the Council the purchase of shares in the Central Factory to the amount of 15,000 dols. He spoke of the many difficulties the factory had had to contend with in unexpected breakages and other accidents. It had now become absolutely necessary to stop the work for some eight or ten days to do certain repairs, without which the factory could not work profitably. These repairs could not be done with the means in hand, therefore the managers had petitioned that the Colonial Treasury should furnish the money by taking shares to that amount. There was now no longer any question that the *system* of the factory was a good and profitable one. Its managers had proved their competence to overcome difficulties; *e.g.*, that of the juice turning sour, and another difficulty connected with the first entrance of the juice into the factory itself. The advantages of the factory mode of transporting juice were felt by estates already. The sugar made was unequalled in the world.

The only question now was whether the factory could make enough sugar to give sufficient profit and such as was expected. Some of the breakages were very inconsiderable, but it was difficult to get repairs properly done where there were no foundries, and so it had become advisable to stop a short while and make thorough repairs, especially as some materials had lately arrived. The financial position of the factory was simply this. The expenses from 5th March to 20th June are 127,746 dols., which includes 13,223 dols. spent in connection with building, and therefore not fairly to be charged as working expenses. The value of the sugar already sold with what is still in hand is 131,500 dols. The factory is therefore solvent. It certainly has some defects at present; *e.g.*, there is more steam wanted, both at the stations and in the factory itself, if it is to produce all it is capable of, viz., 50 tons a day. There has not been any higher amount reached than from 30 to 35 tons a day. Of course the frequent accidents to machinery have made the amount less, so that the actual average rate of production is not more than  $12\frac{1}{2}\%$  tons a day. He called special attention to this fact, because it proves that even with the low amount produced the factory can cover all its *working* expenses. And these, he would also remark, are in reality less than Mr. Hagemann's estimate of what they would be. If the factory is ever brought up to working power, then all above the present average of production can be considered profit, after deducting payment for the canes; *e.g.*, if for canes which will make one ton of sugar the payment is 60 dols., and the value of the sugar is 100 dols., then there is a net profit of 40 dols. on each ton over  $12\frac{1}{2}\%$ . It may be said that the factory should have had reserve pieces of machinery to provide against accidents. This was not overlooked. It was also well understood from the first how desirable it would have been to go to more expense and make the factory more complete. But this could not be afforded, and the estimate of the things needful as reserves was 9000 dols., too large for us to get them at all. Our poverty, in fact, was the cause of the factory's present condition, as it prevented us from having a sufficient working capital. The capital is too limited, and the cash amount usable here still more so. The factory has been

working on the sale of the produce. But it has now come to this, that it must either stop for want of means or that the means in some shape must be furnished to make such repairs as will enable it to work efficiently to the end of this campaign. Taking shares in the concern seems the best and easiest way for the Government to serve both the factory and the community. The shares to the amount of 15,000 dols. are to be taken, if the Council approves, under the supposition that the Home Government will lend from the State Treasury another 15,000 dols. This whole amount of 30,000 dols. will enable the factory not only to make the present repairs, but to get larger boilers and other necessities from Europe for next year. It is not to be expected that even with the present help the factory can reach this year its full capacity of 50 tons a day. But the managers have no doubt that after the present repairs they will easily reach a minimum of 130 tons a week, or about 23 tons a day for the six working days of the week. If this expectation is realised, the gain in comparison with the present time will be about 480 dols. *per day* net revenue. The factory will thus be able, though there only remains a short time of the present campaign, to make sufficient profit to meet the interest payable on the shares, viz., 30,000 dols., already guaranteed, and which, if the factory stops, the Colonial Treasury would have to pay out. The money, therefore, will not be lost, as it is stipulated in the ordinance about the guarantee that the amount guaranteed shall be returned to the Treasury from the profits of the factory. He had no doubt that in future the factory would be able to work without assistance.

The Chairman having requested Rev. Branch to act *pro tem.* as chairman (the vice-chairman being absent), spoke to this effect:— All the members present to-day must feel serious thoughts about their responsibility, both to themselves and the community, in connection with this measure. But the members who are absent must feel much more serious thoughts, as their absence prevents their discharging this great responsibility. Our action entirely depends on our confidence in the factory. If it is really a failure, let us give it no more money. If it will bring ruin and enormous inconvenience by confusing the labour system, then do away with it. But he had

heard nothing whatever to justify the belief that it was a failure. And as regards disturbing labour, in time the factory would naturally get its regular staff of labourers. It cannot be an impossible thing in this country to work a manufactory alongside of agricultural pursuits. Our hopes in reference to the factory have certainly not been fulfilled. We showed our confidence and our interest in it by voting bill after bill, and having meeting after meeting, in the Colonial Council and out of it. There are very few in this island, whatever some may now say to the contrary, in reference to whom there is not evidence in black and white that they had this confidence. We obtained benefits from the mother country under the shield of the Central Factory. The very last subsidy of 250,000 dols. given last year was only given by the Home Government on the strength of the Central Factory. All were agreed until the factory chimney sent out its first smoke. The Colonial Council expressed its regret eight months ago that it could not take more shares than those we received for the Steamplough. Accidents cannot affect the principle of the factory. We are only asked to do now what we were willing to do then, and did not do only from want of money, not from want of confidence. The question for the factory is whether it must close its campaign or carry it on, if not to a perfectly satisfactory end, at least to a less unsatisfactory one than it had once feared. To close now would greatly damage many estates—those with superabundant canes, and those with no works. And then there would be the certainty of our having still to pay up the amount of guarantee. Some of the accidents had been not from carelessness, but from bad machinery. It must be remembered that the 15,000 dols. was not asked for as a loan or a gift. It was to be invested in shares, which must pay in the prosperous days of the factory. Any member having confidence in the future of the factory must therefore vote for this expenditure. Anyone who believed that it could never pay under any circumstances was bound to oppose it.

The Chairman then proposed that a committee of the whole House sit at once for the consideration of the question, and invite the attendance of Messrs. Hagemann and Wassard.

The Chairman then resumed the chair.

The Governor remarked, that as regards our hopes about the factory not having been fulfilled, it must at least be acknowledged that it is able to offer planters the full benefit which was promised. Every planter who has delivered canes knows this benefit now.

His Excellency further regretted the absence of so many members to-day, especially of those who perhaps entertained opinions against the factory. If there were any such members, they ought to have felt themselves bound to attend to-day and give utterance to their feelings. The only right way was to speak out such things boldly and clearly, so that elucidations may be given, and every member then be able to judge for himself.

The proposal for a committee was then unanimously carried, and after a few minutes' recess the committee had a very long sitting, at which Messrs. Hagemann and Wassard were present, and furnished all the information asked of them, confirming fully the Governor's statements.

On the resumption of the Council the proposal of the Government was then brought forward as a money bill, and went to a first formal discussion.

Dr. Kalmer inquired whether the States Treasury was certain to advance the 15,000 dols. spoken of. It seemed to him that according to the original Government guarantee this could not be a matter of any doubt. He also inquired whether the amount now granted would be sufficient to enable the factory to have such an income that it could carry out further improvements and still pay interest, so that the Colonial Treasury would have no further outlay.

The Governor said that a definite and distinct answer to the first question was impossible, until the Minister of Finance had given his opinion; but he personally entertained no doubt that the Home Government would make no objection. To the second question he would only say that the factory wanted cash at present; but if it were able to make 23 tons a day, any advances made to it could be restored.

The discussion closed, and the bill passed at once to a second discussion, and was finally carried by nine votes, Mr. Latimer alone voting against it.

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We select the following passages from an Editorial in the *Avis*,



commenting on the position of the factory and in approval of the meeting's decision :—

“It is not much more than three months since the Central Factory commenced operations, and yet the interest and anxiety with which its course has been followed makes that short period seem a long time.”

“A scheme which gets half its money as a loan from the Danish people, which gets grants of land from the local legislature, and from the same source obtains relief from taxation, and a guarantee of interest for its shareholders, cannot be looked upon as a private concern.”

“Now that we have the outline of the Governor's statement to the Council last Monday before us, we congratulate ourselves on the stand we have taken ; for we find that the position of the Factory is not nearly so bad as we and the public generally had feared that it might be. Far from being a failure, the factory is at the present moment perfectly solvent, and the prospects, if not brilliant, are certainly reassuring. Let us see how the matter really stands. We have before us reliable information as to the principal difficulties that have accompanied the work, and will give two or three examples. The shaft of the centrifugal pump by which the sea water was driven through the condensers was in part made of iron, and wore out so quickly that it frequently needed repairs and caused delay. It will be immediately replaced with a shaft entirely of steel. The packing of the pumps gave way and caused great delay in moving the juice from one part of the works to another. This will now be replaced in a more substantial manner. The copper coils in the vacuum pan broke loose from their supports, and had frequently to be replaced at the cost of much valuable time. They will be firmly secured during the present rest, and it is hoped will give no further trouble. Such are samples of the obstructions from which the work has suffered. They are apparently small matters ; but it must be remembered that where the chain of processes is continuous, as it is in this instance, the giving way of one link stops the whole. In spite of such difficulties as these, how does the factory at the present

moment stand? The Governor tells the Council that while the total outgo for canes and working expenses, including 13,323 dols. which should properly have been charged under cost of erection, has been 127,746 dols.; the value of produce sold and on hand is 131,500 dols., so that the factory is solvent with 4,754 dols. to the good. This balance on the favourable side has been made by an average production of only 12  $\frac{3}{4}$  tons of sugar per day. It would not of course do to continue at this slow rate, for then the interest due in March next year could not be paid; but if we find that *even with such a slow rate* the factory can pay its expenses, then we may readily believe that with the rate increased to 23 tons a day for the remainder of the season, there will be quite sufficient profit to pay interest as well as expenses, and perhaps leave a margin besides.

The managers admit that the capital defect is the want of sufficient steam power both in the central building and at the stations. This defect cannot of course be remedied now, but it can be after the crop is finished. The factory will then, it is hoped, be in a position to make 50 tons of sugar daily, and this would be sufficient to take off the entire crops of the contracted estates. Till this is done we cannot say that the enterprise has reached its goal. So long as even one planter is left to grind a single acre of canes at his own works, the factory has not done what it was intended to do, namely, set the planter free from the manufacture to attend solely to his fields. This is what must be striven for."

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SORGHUM SUGAR.—A sample of sugar, made from the Minnesota Amber Sorghum, was shown us the other day by H. W. Montgomery, Esq., 160, Common-street. It was in color like what is known to sugar makers as yellow centrifugal. It seemed very dry—much more so than a similar grade made from sugar cane. If this variety of sorghum produces a juice that will granulate and make a hogshhead or more to the acre—as it is claimed it will do—the production of sugar in this country is yet in its infancy. We confess to a liberal amount of scepticism upon the subject, and shall watch the experiments now being made in the south with great interest.—*Our Home Journal* (New Orleans).

## VERIFICATION OF GRADUATED GLASS VESSELS AND AREOMETERS FROM 4° TO 45° C.

By P. CASAMAJOR.

Read before the American Chemical Society, July 11th, 1878, and obligingly sent by the author for publication in the "*Sugar Cane*."

The graduated glass vessels used in laboratories, are generally divided into cubic centimetres, and the volumes designated are supposed to be correct at a certain temperature, taken as a normal, which is generally 15° C.

I propose this evening to give a table (No. 2) for the verification of these graduations at all degrees of temperature, from 4° to 45° C., in which will be found, for every degree, the weight of distilled water which will occupy a space which at 15° C. is equal to 100 c.c.

Afterwards I will consider the verification of the graduations of areometers.

It is needless to add that the methods used for the verification can be easily applied to the graduation of measuring vessels and of areometers.

Let us suppose that we have a graduated flask, capable of holding 100 c.c. of water at 15° C., when filled up to a line etched on its neck, and that we wish to know if this graduation is correct. To ascertain this, we may fill up the flask with distilled water, at the temperature of 15° C., up to the line on its neck, and find whether the weight of the water is the proper weight. This leads us to inquire: What is the weight of distilled water which, at 15° C., will occupy exactly 100 cubic centimetres?

For the solution of this question we have to make use of Table No. 1, which has already been published twice in our Proceedings,\* but which must be given again in this place, as it is to be the base of all our calculations. In this table, as here given, the temperatures

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\* *Proceedings of the American Chemical Society*, vol. I, First Part, p. 193; Part Second, p. 20. Also see *American Chemist* for January, 1877, p. 251; *Chemical News*, vol. XXXV., p. 161; *Moniteur Scientifique*, vol. VII., third series, August, 1877, p. 862; and *Sugar Cane*, April, 1878, p. 177.

range from  $4^{\circ}$  to  $45^{\circ}$  C., while, as previously published, the lowest temperature was  $5^{\circ}$ .

In the first column of this table are the temperatures for every degree, from  $4^{\circ}$  to  $45^{\circ}$  C. Opposite to these, in the second column, are to be found, for every degree, numbers representing the absolute expansions of 1 c.c. of water, starting from  $15^{\circ}$  C. as a normal. For the degrees below  $15^{\circ}$  the numbers in this column represent absolute contractions, and are to be subtracted. We may see, in the second column, that if we take 1 c.c. of water, and heat it to  $16^{\circ}$ , it will become 1.000173 c.c.; if heated to  $25^{\circ}$ , it will become 1.002179 c.c., &c. If, instead of heating, the temperature is lowered from  $15^{\circ}$  to  $14^{\circ}$ , 1 c.c. of water will become  $1 - 0.000150 = 0.999850$  c.c.; if cooled to  $7^{\circ}$ , it will become  $1 - 0.000820 = 0.999180$  c.c., &c.

For the methods used in obtaining these numbers I must refer you to the Proceedings of this Society—vol. 1, First Part, p. 193.\*

TABLE No. 1.  
*Total Expansions from  $15^{\circ}$  C.*

Degree Centigrade	Absolute Expansion.	Relative Expansion.	Degree Centigrade	Absolute Expansion.	Relative Expansion.
$4^{\circ}$	0.000887	0.000600	$25^{\circ}$	0.002179	0.001919
$5^{\circ}$	0.000878	0.000612	$26^{\circ}$	0.002445	0.002159
$6^{\circ}$	0.000856	0.000622	$27^{\circ}$	0.002717	0.002405
$7^{\circ}$	0.000820	0.000612	$28^{\circ}$	0.002995	0.002657
$8^{\circ}$	0.000772	0.000590	$29^{\circ}$	0.003279	0.002913
$9^{\circ}$	0.000706	0.000550	$30^{\circ}$	0.003569	0.003179
$10^{\circ}$	0.000622	0.000492	$31^{\circ}$	0.003869	0.003453
$11^{\circ}$	0.000524	0.000420	$32^{\circ}$	0.004181	0.003739
$12^{\circ}$	0.000412	0.000334	$33^{\circ}$	0.004503	0.004035
$13^{\circ}$	0.000288	0.000236	$34^{\circ}$	0.004836	0.004342
$14^{\circ}$	0.000150	0.000124	$35^{\circ}$	0.005180	0.004660
$15^{\circ}$	Normal	Normal	$36^{\circ}$	0.005533	0.004987
$16^{\circ}$	0.000173	0.000147	$37^{\circ}$	0.005895	0.005323
$17^{\circ}$	0.000357	0.000305	$38^{\circ}$	0.006265	0.005667
$18^{\circ}$	0.000551	0.000473	$39^{\circ}$	0.006644	0.006040
$19^{\circ}$	0.000756	0.000652	$40^{\circ}$	0.007032	0.006382
$20^{\circ}$	0.000971	0.000841	$41^{\circ}$	0.007428	0.006752
$21^{\circ}$	0.001119	0.001039	$42^{\circ}$	0.007832	0.007130
$22^{\circ}$	0.001428	0.001246	$43^{\circ}$	0.008244	0.007516
$23^{\circ}$	0.001670	0.001462	$44^{\circ}$	0.008664	0.007910
$24^{\circ}$	0.001920	0.001686	$45^{\circ}$	0.009092	0.008312

\* Also *American Chemist*, loc. cit.; *Chemical News*, vol. XXXV., p. 161; and *Moniteur Scientifique* for March, 1877, p. 237.

The numbers of the third column represent the total *relative* expansions of 1 c.c. of water, starting from 15° C. as a normal. They were obtained by subtracting the number 0.000026, the co-efficient of expansion of glass for 1° C. as many times, from the quantities in the second column, as there are units between the corresponding number of degrees and 15° C. The numbers in this third column represent the apparent expansion of water in glass vessels.

If we wish to know the weight, in grammes, of 100 c.c. of distilled water at 15° C., we must refer to the definition of the gramme, which is: *the weight of 1 c.c. of distilled water at 4° C., taken in vacuo.*

By referring to the second column of Table No. 1, we may see that if we take 1 c.c. of water at 15° C, and lower the temperature to 4°, the cubic centimetre of water becomes  $1 - 0.000887 = 0.999113$  c.c., which will weigh *in vacuo* 0.999113 grammes; therefore, the weight of 100 c.c. of distilled water at 15° C. and *in vacuo* is 99.9113 grammes. To make this result of practical value, we must proceed to eliminate the two conditions of weighing *in vacuo* and at the temperature of 15°.

It is no easy matter to keep liquids for any length of time at a temperature different from that of the room in which we operate, and, when the temperature of the liquid is much lower than that of the room, condensation of moisture takes place on the surface of the vessel which holds the liquid, which circumstance interferes with accurate weighing.

As the most favourable condition is that the temperature of the liquid be the same as that of the room, I give, in the second column of Table No. 2, the quantity of distilled water to be weighed *in vacuo* at every degree from 4° to 45° C, so that the volume shall be that which in a glass vessel, at 15° is equal to 100 c.c. We will afterwards eliminate the conditions of weighing *in vacuo*.

If we had a flask made of a material which would not expand by the action of heat, and this flask had a volume of 100 c.c., we could calculate, from the second column of Table No. 1, for every degree of temperature above and below 15°, the weight of water which is equivalent to 99.9113 grammes at 15°, or, in other words, the weight of water which would occupy 100 c.c. For instance, the weight at 16° would

be  $99.9113 \times \frac{1}{1.000173}$ , and so on for every temperature above  $15^{\circ}$ . For  $14^{\circ}$ , we would find  $\frac{99.9113}{1.000150}$ , and so on for every temperature below  $15^{\circ}$ .

TABLE No. 2.

*Weight, in grammes, of distilled water, occupying a volume, in a glass vessel, equal to 100 c.c. at  $15^{\circ}$  C.*

Degrees Centigrade.	Weight of distilled water in vacuo.	Weight of distilled water at pressure =760 mm. of mercury.	Degrees Centigrade.	Weight of distilled water in vacuo.	Weight of distilled water at pressure =760 mm. of mercury.
4°	99.9712	99.8595	25°	99.7200	99.6163
5°	99.9723	99.8610	26°	99.6960	99.5927
6°	99.9735	99.8626	27°	99.6716	99.5686
7°	99.9723	99.8618	28°	99.6465	99.5439
8°	99.9702	99.8601	29°	99.6211	99.5189
9°	99.9662	99.8565	30°	99.5945	99.4926
10°	99.9604	99.8512	31°	99.5674	99.4658
11°	99.9532	99.8444	32°	99.5390	99.4377
12°	99.9446	99.8362	33°	99.5097	99.4087
13°	99.9348	99.8268	34°	99.4793	99.3787
14°	99.9237	99.8161	35°	99.4479	99.3476
15°	99.9113	99.8041	36°	99.4155	99.3155
16°	99.8965	99.7896	37°	99.3723	99.2726
17°	99.8818	99.7753	38°	99.3482	99.2488
18°	99.8640	99.7578	39°	99.3114	99.2124
19°	99.8462	99.7404	40°	99.2777	99.1790
20°	99.8273	99.7218	41°	99.2412	99.1428
21°	99.8075	99.7024	42°	99.2040	99.1060
22°	99.7869	99.6821	43°	99.1660	99.0682
23°	99.7554	99.6610	44°	99.1272	99.0298
24°	99.7431	99.6390	45°	99.0877	98.9906

As, however, we have to deal with a glass flask, whose volume varies with the temperature, we must use the third column of Table No. 1, the numbers of which were obtained, as we have already said, by subtracting from the corresponding numbers in the second column the number 0.000026, the co-efficient of expansion of glass as many times as there are units in the difference between the number expressing the degree of temperature and  $15^{\circ}$  C.

If we have a glass vessel holding 1 cubic centimetre of water at  $15^{\circ}$ , and if we mark the place on its neck which corresponds to the surface of the liquid, when we come to raise the temperature of the vessel and its contents to  $16^{\circ}$ , the liquid will expand, as we have

said, to 1.000173 c.c.; but the volume, marked on the glass vessel, will itself expand to 1.000026 c.c., and the expansion of the liquid beyond the line on the glass would be the difference = 0.000147 c.c., and the weight of liquid below the line would be  $\frac{0.999113}{1.000147}$  grammes. If the flask is capable of holding 100 c.c. at 15°, up to a line on its neck, the weight up to that line at 16° would be  $\frac{99.9113}{1.000147} = 99.8965$ . By proceeding in the same manner for all temperatures up to 45°, we obtain a series of numbers expressing the weight in grammes, taken *in vacuo*, which will occupy a volume in a glass vessel which, at 15°, is equal to 100 cubic centimetres. These we place in the second column of Table No. 2.

For temperatures below 15°, we may notice, that if we cool down 1 c.c., from 15° to 14°, the volume is reduced to 1—0.000124 = 0.999876 c.c., and, consequently, to fill up the flask up to the mark representing 100 c.c. at 15°, we must weigh  $\frac{99.9113}{0.999876} = 99.9237$  grammes. In the same manner we obtain the weights for temperatures down to 4° C., and we also place the numbers thus obtained in the second column of Table No. 2.

We may now proceed to eliminate the condition of weighing *in vacuo*, by considering that a body, placed in a medium, loses a weight equal to that of the medium displaced.

Therefore, if we subtract, from the numbers of the second column, the weight of 100 c.c. of air at the atmospheric pressure, and at the various temperatures from 4° to 45° C., we obtain quantities expressing the number of grammes of distilled water, which, at the pressure of the atmosphere, would occupy a space in a glass vessel, which at 15° is equal to 100 c.c. We have done this for the pressure equal to 760 millimetres of mercury, the normal pressure of the atmosphere. At this pressure, and at 0° C., 100 cubic centimetres of air weigh 0.1293 grammes, and we may take this weight as the base of our calculations; but we may take into account the weight of air displaced by the brass weights, placed on the other pan of the balance, which is to be subtracted. As all the larger weights used by chemists are made of brass, where specific gravity

is 8, we should take  $\frac{7}{8}$  of  $0.1293 = 0.1132$  grammes, which is the difference of the weight of air displaced at  $0^{\circ}$  C. by 100 c.c. of water, and by the corresponding brass weights.

The expansion of air for every degree Centigrade is equal to 0.00366, and, therefore, the weight of air, which at every degree of temperature occupies the same volume as 0.1132 grammes at 0, is :

$$\frac{0.1132}{1 + 0.00366 t},$$

$t$  being the degree Centigrade.

By subtracting the numbers thus obtained from those of the second column of Table No. 2, we obtain in a third column the number of grammes of distilled water, which, at the normal pressure of the atmosphere, and for every degree from  $4^{\circ}$  to  $45^{\circ}$  C., we are to weigh, so as to fill up a volume in a glass vessel, which at  $15^{\circ}$  is equal to 100 cubic centimetres.\*

In conclusion of this first part, which relates to graduated measuring vessels, I propose to repeat what I have said on a previous occasion (*Proceedings of A. C. S.*, vol. 1, second part, p. 23, foot note), to show the accuracy of the numbers in Table No. 1. I do this because, if I have been successful in explaining what I had to say, you must be satisfied that if Table No. 1 is correct, Table No. 2 is equally so.

A long time before calculating Table No. 1 I found directly, by experiment (*American Chemist*, June, 1874, p. 449; and *Sugar Cane*, September, 1874, p. 460), that the total relative expansion of water from  $5^{\circ}$  to  $45^{\circ}$  C. was 0.00021. Now, if we calculate this same quantity from Table No. 1, by adding the total contraction at  $5^{\circ}$  (0.000612) to the total expansion at  $45^{\circ}$  (0.008312), the sum 0.000612 and 0.008312, contain the accumulated errors of this table.†

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\* As the capacity equal to 100 c.c. at  $15^{\circ}$  in a glass vessel varies with, the temperature, a further correction might be made for this variation, but it is so insignificant as not to affect the 4th decimal at  $45^{\circ}$  C.

† The table of Dr. Hermann Kopp agrees still more closely with the result I found; it gives for the mean expansion for  $1^{\circ}$ , between  $4^{\circ}$  and  $45^{\circ}$  C., 0.000209. (See *American Chemist*, June, 1874, p. 449.)



## VERIFICATION OF AREOMETERS.

The areometer, whose correctness we have to verify, may either indicate specific gravities, or its scale is one whose divisions are equal to one another. In the latter case, the specific gravity corresponding to any division of the scale may be found by the formulas which were given in the paper *On Areometers*, which I had the honour of reading before this Society in the month of April of last year.

In these formulas N is the total number of degrees of even scale, d a degree of this scale, and P the corresponding specific gravity.

$$\begin{aligned} \text{We have :—} \quad N &= \frac{Pd}{P-1} \\ P &= \frac{N}{N-d} \\ d &= N \frac{N}{P} \end{aligned}$$

If, for instance, we take for the specific gravity of sulphuric acid,  $H^2SO^4$ , the number 1.845, found by Dr. Ure, and use Beaumé's areometer, in which this specific gravity corresponds to 66°, we have  $N = \frac{1.845 \times 66}{0.845} = 144.02$ , which is as near as possible the generally accepted standard for Beaumé's areometer in Germany and in this country, in which  $N=144$ . As, however, graduation of even scale can never be anything but a conventional matter, any other number, N, founded on any other specific gravity, as determined by any other chemist, would be equally good, provided this other number, N, was generally accepted.

In the paper to which I have referred, mention was made several times of the verification of areometers by ascertaining the corresponding specific gravity by the balance; but I did not enter into any details as to the manner of taking these specific gravities. I propose to do this now, as the subject is one of great importance, and more open to misunderstandings than I had supposed.

We must, in the first place, recall the definition of the specific gravity of a liquid, which is: *the quotient obtained by dividing the weight of a certain volume of the liquid by the weight of the same volume of water, both weights being taken at the same temperature and the same pressure.*

If our measuring vessels retained a constant volume at all temperatures, and if the dilatation of all liquids was the same for equal variations of temperature, the specific gravity of a liquid, which is its weight, compared with that of water, under the same volume, would be the same at all temperatures. If at 4°, and *in vacuo*, 100 c.c. of a liquid, whose specific gravity is 1.5, weigh 150 grammes, at 25°, and *in vacuo*, the weight of 100 c.c. of water being  $\frac{1}{1.003037} = 99.69$  grammes, the weight of 100 c.c. of the liquid in question would be  $99.69 \times 1.5 = 149.535$  grammes.

As the volumes of glass vessels increase by heat, and as the expansions of liquids are different for the same variation of temperature, it is customary in areometers, as in measuring vessels, to specify that the graduations are taken at a certain temperature, which is generally 15° C.

For the purpose of testing areometers, and, in general, for taking the specific gravities of liquids at 15°, it is very convenient to have a glass flask, which, at 15° and at the pressure of the atmosphere, holds exactly 100 grammes of distilled water up to a line on its neck. Then the number of grammes gives directly the specific gravity, at 15°, of any liquid, occupying the same space, without further calculation.

Now, I wish to call to your attention, that, if we have a flask graduated in this manner, we may, at any temperature, obtain indications to verify the scales of areometers.

If the temperature of the liquid is different from 15°, and the areometer marks 1.5 specific gravity, the indication is not correct on account of the variation of the volume of the liquid and of the areometer. But, if we keep the liquid at the same temperature, and place it in the flask, so as to fill the volume, which, at 15°, holds 100 grammes of water, and we find that the weight of the liquid is 150 grammes, we may conclude that the areometer which showed 1.5 sp. gr. was correct.

The reason for this conclusion is, that, although both indications are incorrect, the error depends on the expansion of glass and the expansion of the liquid, and these are exactly the same in both cases; therefore, if these errors were eliminated, the equality would still persist.

To express this proposition algebraically, suppose that  $a$  and  $b$  are the indications that we would have at  $15^\circ$  with the areometer and the flask respectively, and that  $x$  and  $y$  are the errors in each case from operating at a temperature different from  $15^\circ$ . If  $a+x=b+y$ , and if at the same time  $x=y$ , then  $a=b$ .

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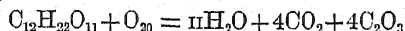
### ELEMENTARY ORGANIC ANALYSIS BY A MOIST PROCESS.

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Read before the Chemical section of the British Association, Dublin,  
August, 1878.

Under this title we describe the further development of the researches which were published from the Laboratory of the London Institution some ten years ago (Historical Sketch of the Limited Oxidation). We have continued these investigations by taking up the study of the oxidation of organic substances in alkaline solution by means of permanganate of potash, and have obtained the following results:—

An aqueous solution of cane sugar is rapidly oxidised by excess of permanganate of potash in presence of some three times its weight of potash, and, if the materials be evaporated to dryness in the water-bath, is totally oxidised according to the following equation:—



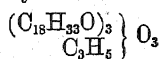
We took cane sugar 1.0 gramme, solid potash 3.9 grammes, permanganate of potash 7.0 grammes, and about 150 c.c. of distilled water, and heated the materials in the water-bath, continuing the evaporation almost to dryness. We then added a considerable quantity of distilled water, titrated the excess of permanganate, filtered from the brown hydrated binoxide of manganese, which is formed during the reaction, and submitted the entire filtrate to precipitation with chloride of calcium and excess of acetic acid. We washed, dried, and ignited the resulting oxalate of lime, and weighed the carbonate of lime thereby produced, which equalled 1.204 grammes. The oxygen

consumed was found by titration to be .9351 grammes. We have, therefore, experimentally, carbon as oxalate, 0.289 grammes; oxygen consumed, 0.9351 grammes; and the theory requires carbon as oxalate, 0.281 grammes; oxygen consumed, 0.9356 grammes; which accords sufficiently well. We have directed an evaporation of the material down to dryness in order that the experiment may be sure to succeed. If this point be neglected only about  $\frac{1}{10}$  of the theoretical quantity of oxygen may be consumed, and  $\frac{1}{2}$  of the correct quantity of oxalate be produced, as was illustrated in our earlier experiments, which we need not publish.

Our experiments on grape sugar were made before we had discovered the secret how to get the oxidation complete. We obtained from 100 parts of grape sugar 20.7 parts of carbon as oxalate. The theory  $C_6H_{12}O_6 + O_{10} = 6H_2O + 2CO_2 + 2C_2O_3$  requires carbon as oxalate 26.6. This experiment requires repetition with proper regard to the conditions.

The experiment with glycerine was likewise made before we had adopted the precaution of evaporating to dryness in the water-bath. From 2.78 grammes of glycerine we obtained 0.535 grammes of carbon as oxalate.

Train oil, which we may take to be mainly oleate of glycerine



behaves in a most interesting manner when subjected to the action of strongly alkaline permanganate. We quote from our note book:—Train oil, 3.184 grammes; solid potash, 14.5 grammes; permanganate of potash, 50.0 grammes; distilled water 500 c.c. These materials having been put together there was little action between 100° Cent., but on evaporation in the water bath the action became very rapid at approaching dryness, and the permanganate was almost completely used up. A large quantity of oxalic acid was produced and converted into oxalate of lime, which was burnt into carbonate of lime, yielding 5.248 grammes of carbonate of lime. It was from this and another experiment on almond oil that we learnt the

importance of the evaporation to dryness. Both experiments are incomplete, but they show that such complex and stable substances as the animal and vegetable fats are amenable to this method of treatment.

Benzoic acid was powerfully attacked on being taken to dryness in the water bath with alkaline permanganate. It appeared to give a very little oxalate.

Lactic acid was attacked even in the cold.

Acetic acid resists most strongly, and apparently absolutely.

Alcohol behaves in a most interesting manner. In the cold there is conversion into acetic acid, without intermediate production of aldehyde; and the acetic acid so produced is not subsequently oxidised on heating with excess of potash and permanganate.

The acetic acid was identified by being made into a baryta-salt which yielded 53.75 per cent. of barium. (Theory 53.73.)

No oxalic acid was produced.

Amylic alcohol is oxidised thus:—



and, no doubt, the different varieties of amylic alcohol give different products.

## THE HAWAIIAN ISLANDS AS A SUGAR PRODUCING COUNTRY.

By THOMAS G. THURM, Honolulu.

A short sketch of the history of the sugar industry of the Hawaiian Islands was published in this journal during 1874, whereby it was shown what difficulties the sugar interest had been labouring under ever since it had an existence, and with what hope the country looked for the favourable consummation of the renewed efforts then pending for the Treaty of Reciprocity with the United States, not only to revive the struggling interest, but implant new vigour and spirit into the industry by the removal of the heavy duties upon its productions when exported to the United States.

Those acquainted with the capabilities of the soil felt confident in the rich field of production offered to planters here, and especially so if our nearest neighbours should become our customers without so exorbitant a tax as that imposed by their government.

The rapid changes that have taken place throughout the sugar districts of the group since the promulgation of the treaty—nearly two years since—proves the correctness of those views, as for a long time the number of plantations stood at from 30 to 33, which in December last reached 46, and is now still further increased to over 50. Nor does this difference in the number of plantations show the extent of increase in the industry; for in many locations cane planting on the co-operative plan has been largely entered into, to be ground by mills already established or guaranteed to be erected. All this extension has been done, as yet, without any additional foreign capital coming into the country.

The almost total absence of last winter's rains, and the long spell of hot dry weather throughout the group has told materially on the present crop, and seriously—in certain localities—on the crop for next year, though recent "trade" showers have encouraged better hopes than were previously entertained. The new sugar extensions in Kau, Hawaii, and on Molokai, as also the Ulupalakua Plantation on Maui, have suffered the most, while those in Hilo, Hamakua, and Kohala on Hawaii, and Haiku, Hamakua, and other windward districts on Maui, have experienced no great drawbacks. The production, notwithstanding, shows a large increase over any former period, as the exports for the six months ending June 30th foot up 24,148,443 lbs., of which 14,711,737 lbs. were exported during the last quarter. This amount for the six months already nearly equals the total amount exported last year, which was 25,575,965 lbs.

In connection with the extension of the sugar planting interest, I would mention the construction of the Haiku Ditch as one of the most extensive enterprises yet undertaken on the islands, whereby the waste waters of streams in the Hamakua district, seventeen miles distant, have been brought in to irrigate the fields of Haiku and Makawao. Along its course several excellent plantation sites have been opened up, and ploughing and planting is being pushed

forward vigorously. The Haiku extension, in a portion of this tract, —or Haiku No. 2 as it is called—have already received their machinery from New York, and now being erected, is all of the largest and most improved kind yet introduced here, although the plant of the Hawaiian Agricultural Co., of Kau, just arrived from London, will be its equal in every way.

It is now mooted that the magnitude of Haiku's ditching and extensive plantation is to pale into insignificance before the much grander scheme of Mr. Klaus Spreckles—"the sugar king of the Pacific"—where waters beyond Haiku's in one direction and from Waihee in another are to be brought to irrigate the extensive plain of central Maui, generally known as Waikapu Common, whereon he is said to expect to produce 40,000 tons of sugar per annum to supply his San Francisco refineries.

An excellent business step it was of the firm of Mirlees, Tait, and Watson, of Glasgow, to have the junior member of the firm visit these islands as he did last winter, who made careful observations in his tour of all established and projected plantations. The result has been to secure to them quite a number of orders for entire plants, and on terms which are said to be largely beneficial to parties here. Mr. W. left these shores greatly impressed with their importance as a sugar producing country, and has remarked that our lands will not much longer lie idle for the want of foreign capital to invest in the same, as all that it needs is to be known. This seems to have been proved already in the result of Mr. Speckles' visit.

From all the information which comes to us from other sugar producing locations, we learn of no yields of sugar to the acre that compare favourably with these islands. It has at no time been a weakness of the press here to "brag" about its productions or its climate, as our neighbours of the Pacific coast delight to do, but in justice to the views, expressed in the foregoing, I may be permitted to mention that four and five tons of sugar to the acre of plant cane is but an ordinary yield for our preferred canes, while favoured localities give at times as high as six tons and over, as was the case recently at the new plantation at Laupahoehoe, where the canes in many instances

measured twelve and fourteen feet long. The yield of this plantation is so much beyond the most sanguine hopes of the parties interested that plans are already made—although but in its first year—for a larger plant, to enable them to take care of the capabilities of their fields. Olowalu Plantation, on Maui, have also been turning out yields in places at over six tons to the acre, the canes of which run to twenty-two and twenty-four feet in length, but of a slimmer variety than that at Laupahoe.

The result of circulars sent to the various plantations a few years since, for statistics, showed the average weight of juice to be a shade under 9° Baumé; and one plantation, that favoured me with its detailed table of yield for a whole grinding season, showed that out of fourteen different lots or patches of cane ground the lowest yield gave 18.54 oz. to the gallon of juice, and the highest 25.69 oz., from open train boiling with vacuum pan finishing. Later work at the same plantation, from improved cane, and worked through with steam altogether, gives results far better than even the famed "Eastes' Process" claims.

Railways are now being projected for the sugar districts of Hamakua and Kau, on Hawaii; levels having been run recently for the Hamakua-Kohala road, to facilitate its agricultural interests, inasmuch as its sea coast affords no harbour or safe anchorage. A small railway of some seven miles in length is now on its way out here for the Hawaiian Agricultural Co., of Kau, to connect their plantation with the nearest shipping port: thus with our increased production comes the improved method of travel and conveyance.

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#### CONTINENTAL NOTES.

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Although the weather during the first part of September was very favourable, and the quality of the beetroot was thereby much improved, unhappily rain has again set in, and the maturity and pulling of the roots has been somewhat retarded, causing many of the *fabricants* to hesitate for a time before commencing work. However, a large number of them commenced some time since, and are now in full operation, and pretty well satisfied—the density and



purity of the juice being fairly good, and if not better, fully equal to that of the same period last year. The following is a comparative table of the analytical results obtained, at the commencement of the two seasons and nearly the same dates, in a *fabrique* at *L'oise*, on roots taken from the same field, and in nearly identical conditions:—

## SEASON 1877-78.

Dates.	Mean Weight of Roots.	Density.	Sugar per Hectare.	Quotient of Purity.
29th August .....	655	6·05	12·66	80·0
8th September.....	920	5·70	11·73	78·6
13th „ .....	925	5·53	11·29	78·4
19th „ .....	915	5·23	10·63	78·1

## SEASON 1878-79.

13th August .....	680	5·55	11·56	79·80
22nd „ .....	620	5·65	12·20	82·70
28th „ .....	670	5·35	11·03	78·80
4th September.....	750	5·75	12·25	81·70
13th „ .....	700	5·22	10·93	80·20

The yield per hectare, judging from the above table, seems to be rather under that of last year, but this is not general, and, under the influence of the late rains, this weight has every chance of increasing.

According to Mr. Licht, of Madgebourg, the production in sugar of the present season, compared with that which has just finished, may be stated as under:—

	1878-79.	1877-78.
Germany .....	395,000	.. 382,500
Austrian Hungary .....	345,000	.. 330,000
Russia and Poland .....	225,000	.. 220,000
Belgium .....	70,000	.. 65,000
Netherlands and other countries	30,000	.. 25,000
Total.....	1,065,000	.. 1,022,000

which will give for 1876-79 a probable excess of 42,500 tons over 1877-78. This is without counting France, which Mr. Licht estimates will produce about the same quantity as last year, viz. : 395,000. However, a much higher yield is likely to be the result, indeed Mr. Demesmay, writing from Arras, estimates the probable yield at 420,000 or 430,000 tons as against 395,000 tons, or a probable excess of from 25,000 to 35,000 tons, which would give a total excess over last season's continental yield of from 67,500 to 77,500 tons. And Mr. Demesmay's estimates are very likely to be realized, as from the large area of land devoted to this season's crop, and noting the comparative table above, there seems to be no doubt but that the yield will be a full one, and that a very considerable excess in the production of sugar over that of last season will result. The *Journal Officiel* has just published the results of the *fabrication*, &c., of the last season, compared with that of 1876-77. In 1877-78, 389,750,238 kilos against 232,770,263 in 1876-77, which gives an excess of 156,980,075 kilos, or about 67 per cent. From the following table it may be seen that the roots of the last season were of an exceptional quality. In the table 90 kilos of beetroot per hectolitre of juice are taken for 1877-78, whilst for the preceding season's that of 100 kilos is the base. Of course, the quantity of roots employed is approximative, but because of the large quantity of water used at the rasper, in the last season's working, 90 kilos is taken as unity for the juice, and as a mean for all the departments.

*Yield per 100 Beetroots.*

Depôts.	Production.	1877-78.	1876-77.	1875-76.	1874-75.
Aisne .....	83,511,077	.. 7.27	.. 5.10	.. 5.20	.. 5.79
Nord .....	99,600,000	.. 7.27	.. 4.95	.. 5.33	.. 5.73
Oise .....	33,600,000	.. 7.59	.. 5.14	.. 5.56	.. 6.10
P. de Calais ..	60,950,000	.. 6.92	.. 4.57	.. 5.19	.. 5.05
Somme .....	54,550,090	.. 7.16	.. 4.92	.. 5.41	.. 5.71
Other Depôts..	57,539,161	.. 7.20	.. 4.99	.. 5.20	.. 5.62

Total.... 389,750,238

Mean yield..... 7.20 .. 5.00 .. 5.20 .. 5.66

Do. in 1873-74, 5.91

Do. in 1872-73, 5.70

The yield of 7·20 for last season is about 44 per cent. better than the yield for the preceding one, which, however, was an exceptionally bad year.

The following table shows the percentage of the different kinds of sugar produced, in relation to the total quantity obtained :—

	1877-78.	1876-77.	1875-76.	1874-75.
Under No. 7....	9 ..	9 ..	3 ..	2
Nos. 7 to 9..	20 ..	22 ..	30 ..	31
„ 10 „ 12..	23 ..	21 ..	16 ..	12
„ 13 „ 14..	4 ..	2 ..	7 ..	10
„ 15 „ 18..	3 ..	5 ..	2 ..	3
„ 19 „ 20..	— ..	— ..	— ..	1
<i>Poudres blanches</i> ..	40 ..	39 ..	37 ..	37
Refined.....	1 ..	2 ..	3 ..	4
	<hr/> 100	<hr/> 100	<hr/> 100	<hr/> 100

In this table one must remark on the proportion of *poudres blanches*, which is very nearly the same—39 to 40 per cent. of the total fabrication, and that it is the same for the sugars below No. 7, 7 to 9 and 10 to 12, known under the name of raw sugars, 52 per cent. The reason is that the bounties on exportation offer, in the case of these sugars, a bait to the *fabricant*, even where his house is adapted for the production of white sugars. Of the produce of 1877-78, there were exported 86,438,583 kilos. of raw sugar, against 11,976,277 kilos. in 1876-77, making a difference of 75 millions. This, however, is 26 millions below the quantity of sugar exported in 1875-76.

The stocks, on the 31st August, stood at 24,246 tons, whilst at the same date last year, they were 38,340 tons.

In a new *memoire* addressed to the Academy of Sciences, MM. Corewinder and Contamine endeavour to show that the saccharine richness of the beetroot is in direct relation with the superficial extent of the foliaceous organs. They affirm that this law suffer little exception, and support their affirmation with numerous experiments made in the months of September and October, 1876-77, on roots of the same origin, grown in the same field, cultivated under the same conditions, and weighing nearly equal weights, a

it is known that small roots are generally richer in sugar than large ones. The authors cite, in their *memoire*, roots of the same weight, in which the saccharine richness differed about 3 per cent; and that the richest roots had their leaves much more extended in surface than the others.

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### THE MANUFACTURE OF BEET SUGAR.

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Having had the privilege of inspecting the operations of its manufacture in the Waghäusel Factory, in Baden, I propose to describe briefly the operations as conducted there.

The beets are weighed in the waggons as they enter the yard, so that they may be transferred directly to the washers, or dumped into a pit, from which they are conveyed to the washer by a series of buckets attached to an endless belt. The beets are fed alternately into one or the other of two horizontal cylinders which revolve to nearly half their diameter in a trough of water. These cylinders or drums are about twelve feet long and four in diameter. They are slightly inclined, and upon opening a door at the lower end the beets come tumbling out at each revolution of the cylinder; they are then caught by a shorter drum with spokes inside and larger openings to permit the escape of small stones and the like. Another endless belt now carries them to the top floor, where they are put into small cars and weighed again under the eyes of the government tax collector.

As soon as weighed they are fed into the cutting machines, where they are sliced, and then grated by a revolving cylinder covered with sharp saw teeth, so that the fibres of the beet when they come out are scarcely one-fourth of an inch long.

The extraction of the juice from the pulp is accomplished in this particular factory by maceration or cold diffusion. Two batteries are employed, each consisting of sixteen vats about four feet deep and of the same diameter. They are connected by pipes in such

a manner that any one of them can be shut out from the circuit at pleasure. No. 1 being filled with a mixture of pulp and pure water is stirred by machinery for a while, being covered with perforated copper plate a few inches below the top of the vat. A brush is attached to the vertical shaft of the stirrer, and revolves with it upon this perforated cover, to keep the holes free from foam, &c. The water passes from one vat to the other successively until it has made the circuit of the batteries, or has become saturated. By this time the first vat has been filled sixteen times with fresh water, and the pulp is sufficiently extracted to be removed. While this is being done, No. 1 is shut out of the battery and fresh water run into No. 2. When No. 1 has been cleaned and filled again, the water from No. 16 passes into No. 1, before being drawn off as saturated. No. 2 is next shut out of the circuit, and refilled with pulp, the fresh water entering No. 3, so that the operation is continuous.

The exhausted pulp is subjected to pressure, and then employed as fodder for horses and cattle.

The solution of sugar, potash, and other salts is now quite black, and after passing through an automatic measuring machine, and over a vibrating sieve to catch any stray fibre, it passes into copper kettles, where it is heated by a coil of steam pipe to coagulate the albuminous substances. While in these kettles diluted milk of lime is added to neutralise the free acid in the juice. Beside neutralising the acid, the lime also precipitates the protoxide of iron and the magnesia from the solution, liberates the potash and soda, and finally unites with a portion of the sugar to form saccharate of lime.

The next operation consists in removing the lime. This is accomplished by means of carbonic acid, which is made by burning limestone in a suitable kiln in the court adjacent, and washed by passing through water. The solution is heated by steam, while the carbonic acid is forced in from beneath. The precipitated carbonate of lime is so loaded with impurities as to be quite black.

The slimy sediment of lime and other impurities is subject to pressure between linen cloths in the "filter press." The thin

syrup, from which, however, part of the water has been removed by boiling in the kettles where the carbonic acid was introduced, is now filtered twice through cylinders containing bone-black, each sixteen feet high. It is next concentrated, *in vacuo*, to thick syrup, again filtered over bone-black, and evaporated in vacuum pans until a sample drawn out upon a plate of glass forms crystals of the proper size on cooling. It is then run into iron moulds, like a large sugar loaf, and left to cool. As it is now a mixture of crystallised sugar and uncrystallisable molasses, it is about the colour of light-brown sugar. This mass, which has just enough consistency to stand alone when inverted and the mould removed, is broken up and thrown into the centrifugal machines, of which there are six in use. The syrup which is thrown out of the sugar is concentrated again and again as long as any crystallisable sugar can be obtained from it. The sugar when dry is not yet perfectly white, and is again refined before being sold. All sugar is sold in the loaf, of which three thousand two hundred are made in one day, at the factory named. In making this quantity of sugar, two hundred tons of beets and eighty tons of coal are consumed; and about one hundred and twenty men and boys, and eighty girls are employed. The works run night and day, but stop on Sunday. The men work twenty-four hours without rest, and then rest twenty-four hours. No smoking is allowed on the premises and intruders are strictly excluded. Even the workmen are searched on leaving the premises.

The bone-black used is regenerated on the premises by fermenting to remove the sugar, treatment with acid to remove the lime salts, and finally burning in iron cylinders surrounded by coal fires, and the air carefully excluded.

An acre of land in Baden will produce on an average 227 cwt. of sugar beets, so that 6000 acres are required to supply this one factory, which gives some idea of the attention which is directed to this industry by agriculturists.—*Boston Journal of Chemistry*.

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## Correspondence.

### SCALE FROM CONCRETOR TRAYS.

TO THE EDITOR OF "THE SUGAR CANE."

Sir,

The composition of the scale which is deposited in vessels used for concentrating cane juice has not received the attention it deserves.

A sample of scale from Concretor trays forwarded by Mr. William Fryar, of Loganholme, Australia, has been subjected to analysis by my son. The result is appended. The scale when heated becomes black, and indicates a considerable quantity of organic matter. The proportion of lime is not greater than might be expected. The large quantity of phosphoric acid is one of the most remarkable peculiarities of the scale. In this respect it resembles the mineral matter which closes the pores of the filter bags used in Refineries. These bags become hard and impervious in a short time, especially if certain varieties of low sugar are used. It was found on analysis that this mineral deposit consisted to a large extent of tribasic phosphate of calcium, the salt in which doubtless the phosphoric acid and lime are mainly associated in the scale from Australia.

Yours truly,

ALFRED FRYER.

### SCALE FROM CONCRETOR TRAYS.

Moisture..	..	..	..	..	..	..	0.08
Lost on Ignition	..	..	..	..	..	..	28.58
Phosphoric Acid	..	..	..	..	..	..	22.35
Insoluble..	..	..	..	..	..	..	0.66
Sulphuric Acid	..	..	..	..	..	..	1.69
Iron, Alumina, &c...	..	..	..	..	..	..	4.61
Alkalies ..	..	..	..	..	..	..	4.52
Lime ..	..	..	..	..	..	..	36.92
							99.41

I found tartaric acid, and suspected other organic acids, &c.

ALFRED COOPER FRYER.

## YIELD OF SUGAR IN THE FIELD.

TO THE EDITOR OF "THE SUGAR CANE."

Sir,

A recent number of the *West Indian* (16th July, 1878,) which has reached me shows that the doctrines I have been advocating in your excellent magazine for some time past, are fully corroborated on all sides by the experiences of the planters. Yes, it is perfectly true, as a leading article in that paper states, that increase of sugar is to be made in the field; though, no doubt, the "preparation," to use a chemical term, of the pure saccharine matter in the boiling-houses, and the method of extracting it from the cells of the cane, will receive great improvements at the hands of the scientific chemist and the engineer. But "unless there is powder and shot in, you cannot get powder and shot out," hence the necessity of looking, principally, for increase of yield in superior cultivation.

One of the correspondents of the *West Indian* alludes to the possible yield of the cane, and gives certain figures which require correction. He says that a single eye from which the plant-cane grows has been found to produce a bunch of 60 canes, which, when cut, weighed 600 lbs., and, when crushed in the mill and boiled, yielded 48 lbs. of sugar. That is exactly at the rate of 8 per cent., and by no means an extraordinary high yield. But he goes on to suppose an acre of land to be planted, and to produce in every hole a bunch of the same size as this. With 1000 holes to the acre, he would get, he tells us, 600,000 lbs. of cane, capable of yielding at least 50,000 lbs. of sugar, which is equal to more than 22 tons of sugar to the acre!

There is nothing wrong in the calculation, as far as the figures go, but I should like to be sure that if 1000 holes existed to the acre, and each hole produced 60 canes, there would be room for them to grow. In an acre there are 43,560 square feet. Could we grow 60,000 canes on so small a surface? There would be considerably less than 1 square foot for each cane, and what



are the roots to do? The estimate is, therefore, very much exaggerated. It would be nearer the truth to cut the statement down to about one-third, and say that 7 tons to the acre is the *maximum* yield of sugar in the *present state of things*.

There are two methods open for increasing this yield, namely, by increasing the saccharine richness of the cane itself, by better cultivation, and the application of proper manures, as we have seen done for the beetroot; and by discovering some better methods for extracting the whole of the *cane-sugar* with production of little or no *glucose*.

Another correspondent states that he got from 964 acres in Trinidad 2065 hhds. of sugar this year with only 1400 cwt. of manure, which is a little over 2 hhds. to the acre. We must not forget that Mr. Haynes, of Barbados, has got 3 hhds. with the Urban Cane Manure, and that similar results are obtained at Porto Rico without much difficulty. It appears, however, that on a certain estate in Trinidad, these 2 hhds. to the acre were considered a larger yield than usual, and the writer, Mr. Olton, assures his readers that pen-manure is worth "all the ammonia and guano put together." Is not this exactly what I have always said? Was it not to come as near as possible to pen-manure, which cannot be always produced, that I recommended the Urban Cane Manure? Has not this recommendation borne fruit in Porto Rico, Barbados, Jamaica, and some parts of Demarara? And is it not perfectly certain that with a proper manure, properly applied,  $2\frac{1}{2}$  to 3 hhds. of sugar should be the lowest yield per acre with the present mechanical and chemical appliances for the extraction? I believe ammonia, guano, and even superphosphates to be exceedingly valuable manures if properly used, but they must not be relied upon alone if we wish to prevent the exhaustion of the soil, and to secure the greatest amount of saccharine matter.

I am, Sir,

Yours, &c.,

T. L. PHIPSON, Ph.D., F.C.S., &c., London.

*Laboratory of Analytical & Experimental Chemistry,  
Putney, London, 20th Sept., 1878.*

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## MONTHLY LIST OF PATENTS.

Communicated by GEORGE DAVIES, C.E., Patent Agent, 4, St. Ann's Square, Manchester.

## ENGLISH.

## APPLICATIONS.

3485. CAMILLE ALPHONSE FAURE, of 44, South Road, Faversham, Kent. *Improvements in centrifugal drying machines.*

3618. HENRY RAWLINGS, of 108, St. Martin's Lane, Westminster. *Improvements in filter-presses.*

## ABRIDGEMENTS.

301. WILLIAM MORGAN BROWN, 38, Southampton Buildings, London. *Improvements in the method of, and in the apparatus for, continuously evaporating cane and other saccharine juices, solutions of salt, and other liquids, increasing in density by evaporation.* (A communication from J. H. White, of Lima, Peru.) This invention consists in the combination with a receiving pan, its series of steam-heated pipe, and a discharge valve, of an evaporating pan having an inclined or contracted bottom, a series of steam-heated pipe placed therein, so as to rest in the surface juice or liquid of least specific gravity, and a discharge valve leading from the evaporating pan; the combination being such as to permit the heated juice or liquid to flow continuously from the receiving into the evaporating pan, where the least dense surface juice or liquid is evaporated, and the denser juice or liquid settles into the contracted bottom, to be discharged in regulated quantity. This process obviates the liability of injuring by over-heating the cane or other juice or liquid to be evaporated, and heat below the bottom of the pan is rendered unnecessary. There may be arranged more than one pan, so that by outlets in the bottom the contents may pass from one to another, or more pans arranged in a series.

372. FREDERICK LUDWIG HAHN DANCHELL, of Oseney Crescent, Camden Town, Middlesex. *Improvements in the method of refining and decolorizing oils, spirits, and syrups.* This invention consists in mixing with the oil or syrup ivory black or animal charcoal, in a minutely powdered condition, and in the proportion of 1 to 4 by weight, or in other proportion according to the condition of the oil or syrup; the mixture is then forced into any convenient form of filter-press, whence the oil, syrup, or spirit issues decolorized and purified or refined.

449. JOHN HENRY JOHNSON, of 47, Lincoln's Inn Fields, Middlesex. *Improvements in the treatment of sugar, and in the apparatus employed therein.* (A communication from Dr. A. Seyferth, of Brunswick, Germany.) This invention consists in washing the sugar with concentrated alcohol charged with sugar, and subsequently separating the concentrated alcohol by means

of absolute alcohol or ether (or by washing the sugar with absolute alcohol or ether), and then recovering the alcohol or ether from the mass by the application of heat to the exterior surfaces of the sugar, through the intervention of division plates, which also form the moulding of the sugar. These plates are corrugated, stepped, or zigzag in shape, so as to divide the mass into multiple prismatic sticks, or segments of a section suitable for subdivision into lumps, and the maximum area of each of which is such as, with the aid of the division plates as conductors of heat in the after process of evaporation, to admit of the heat penetrating the sugar, in order to drive off the clarifying agent, and recover the same for reutilisation as before mentioned.

647. ALEXANDER MELVILLE CLARK, of 53, Chancery Lane, Middlesex. *Improvements in the saccharification of amylaceous matter.* (A communication from E. Delarne & Co., of Paris.) This invention consists in the employment of vegetable acids, particularly of oxalic and tartaric acids, at variable temperatures as may be required, for the saccharification of amylaceous matter, such variable temperatures being produced by means of apparatus allowing the operation to be performed under variable pressure.

1624. CHARLES DENTON ABEL, of 20, Southampton Buildings, Chancery Lane, Middlesex. *Improvements in apparatus employed in the manufacture of loaf or lump sugar.* (A communication from E. Langen, of Cologne, Germany.) This invention relates to the liquoring of the lump sugar after it has solidified in moulds open at two opposite sides, more particularly such as those described in specification to Patent No. 4,647 of 1877; and it also relates to apparatus for removing the division plates that separate the sugar into slabs previously to placing the moulds with the sugar on the drying table. The liquoring table is provided with a vertical plate, having apertures through which the clarifying liquor is forced, and against each of which the one open end of a sugar mould is pressed horizontally by means of screws bearing against a cover closing the other open end of the mould. Spaces are provided, by means of caoutchouc fillets, between the inner surface of the sugar in the mould and the vertical plate and between the outer surface of the sugar and the cover, so that the clarifying liquor has access to the entire inner surface of the sugar, while the green syrup can escape from the entire outer face of the sugar and issue through an aperture in the top of the cover and flow into a trough outside, and the clarifying liquor flows down into another trough beneath the moulds. The supply of clarifying liquor to the moulds is regulated by means of measuring apparatus through which the liquor flows on its way to the liquoring table. The division plates are removed as follows: the mould is placed on a table of such size that the sugar rests thereon while the sides of the mould overhang it. The mould is gripped by claws attached to treadles which pull down the mould

over the table, leaving the sugar and plates on the top of the said table. The division plates are then easily removed, and the mould is again raised so as to surround the slabs of sugar, which may now be removed to the drying table as in the specification of Patent No. 4,647, A.D. 1877.

#### COLONIAL (BRITISH INDIA.)

F. A. BONNEFIN, of the Mauritius. *Improvements in extracting and treating juice from sugar canes and other vegetable substances.*

#### AMERICAN.

203,714. OSCAR W. DONNER, of Brooklyn, New York. *Improvements in apparatus for washing filter bags.* This invention consists in a tube open at one end and pierced in various directions with a number of small openings at the lower end which is closed and smoothly rounded off. This tube is to be inserted through the nozzle into the filter-bag, and the open end connected to a flexible hose leading to a pipe or tank containing hot water, the flow of which is regulated by a stop cock. The water being turned on, the end of the tube is moved slowly lower, and the water squirting through the small holes near the end of the tube, against the interior of the bag, loosens, disintegrates, and permeates the accumulated mud, and also dilutes the heavy filtering-liquid uniformly, and thus causes the same to pass readily through the meshes of the bag to its outside and throughout its entire length. A collar may be fixed at the upper part of the tube to prevent the insertion of the tube so far as to injure the bottom of the bag filter.

203,935. NARCISSE PIGEON, of Brooklyn, New York. *Improvement in process of manufacturing glucose.* This process is as follows:—A water bath is provided with an inner chamber furnished with a mash-agitator, and into this chamber is poured a sufficient quantity of water which is heated by the water bath to about 120° or 125° Fahrenheit. Meal is then introduced in the proportion of 100 parts to 400 or 800 parts of water according to the sweetness or consistency of the syrup to be produced. After mixing the meal with the water, about 5 parts of malt to 100 of meal is introduced and stirred in by the agitator. It is then gradually heated up to about 185° Fahrenheit by heating the water bath and then cooled again to about 152° Fahrenheit. Ten parts more of malt to 100 parts of meal is then added and agitation is kept up for half-an-hour, the bath being kept covered. The mash is then allowed to stand for half-an-hour and agitated for a few minutes. It then stands another hour still kept at 152° Fahrenheit or thereabouts. It is then heated to about 172° or 175° Fahrenheit by raising the temperature of the water bath and then steam is used to raise the temperature to 185° or even 190° Fahrenheit. The liquor is then filtered through a mash-tun with a false bottom and the residuum sprayed with hot water for complete

extraction. The product is then evaporated in vacuum-pan for use as wort, or for table use it is concentrated to 20° or 30 Baumé, then defecated and passed through bag-filters and bone-black, then concentrated to 40° or 42° Baumé and mixed with an equal quantity of cane-sugar syrup. The above is a process for extracting grape-sugar from maize or Indian corn.

204,745. ANDREW D. MARTIN, of Abbeville, Louisiana. *Improvement in evaporating pans.* This invention consists in a tapering sheet metal tank of the same depth throughout its entire length, having transverse partitions which divide it into separate compartments gradually increasing in size. Longitudinal tapering flues extend through all these partitions and terminate at the ends of the tank connecting a smoke box at the wide end to a smoke pipe and stack at the narrow end. A flue beneath the tank leads from the smoke box to a furnace situated at the small end, and the apparatus is set in brickwork. The juice to be evaporated is first placed in the largest compartment of the tank, whence after boiling, it is pumped into the next compartment, and so on until it reaches the last and smallest compartment, where the process of concentration is carried as far as it is possible to carry it in open vessels.

206822. JOHN S. SCHOFIELD, of Macon, Georgia. *Improvement in cane mills.* This invention relates to the construction of the framing for sorgo or cane mills. This frame is formed in two separate and independent parts made of metal, and forming a half bearing for each roller. These two parts are held tightly together by means of screw bolts and nuts, which also regulate the pressure of the rollers. The journal of one of the rollers projects above the machine, and is provided with a socket, or casting, to receive the operating lever or sweep.

☞ No returns from other foreign countries this month.

### SUGAR STATISTICS—GREAT BRITAIN.

To SEPT. 14TH, 1878 AND 1877. IN THOUSANDS OF TONS, TO  
THE NEAREST THOUSAND.

	STOCKS.		IMPORTS.		DELIVERIES.	
	1878.	1877.	1878.	1877.	1878.	1877.
London . . . .	72	88	193	223	217	187
Liverpool ..	35	31	147	149	142	136
Bristol . . . .	4	2	34	31	32	32
Clyde . . . . .	62	43	198	189	176	162
Total ..	173	164	572	592	567	517
	Increase.. 9		Decrease.. 20		Increase.. 50	

STOCKS OF SUGAR IN THE CHIEF MARKETS OF THE WORLD ON THE  
1ST AUGUST, FOR THREE YEARS, IN THOUSANDS OF  
TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
191	72	28	14	3	308	293	335

CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING  
1ST AUGUST, IN THOUSANDS OF TONS.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
921	269	25	291	189	1695	1534	1638

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE,  
FOR THE ENSUING SEASON, COMPARED WITH THAT OF THE THREE  
PREVIOUS SEASONS.

(From *Licht's Monthly Circular*.)

	1878-79.	1877-78.	1876-77.	1875-76.
	Tons.	Tons.	Tons.	Tons.
France .....	395,000 ..	395,000 ..	243,295 ..	462,259
Germany (Zollverein) ..	395,000 ..	382,500 ..	291,204 ..	346,646
Austro-Hungary ....	345,000 ..	330,000 ..	247,175 ..	208,912
Russia and Poland ..	225,000 ..	220,000 ..	250,000 ..	245,000
Belgium .....	70,000 ..	65,000 ..	44,467 ..	79,796
Holland and other Countries.....	30,000 ..	25,000 ..	25,000 ..	30,000
Total.....	<u>1,460,000</u>	<u>1,417,500</u>	<u>1,101,141</u>	<u>1,372,613</u>

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STATE AND PROSPECTS OF THE SUGAR MARKET.

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The Sugar Market during the past month has been very quiet, and prices of raw sugar have slightly given way. French loaves are also about 3d. cheaper, whilst the finer kinds of crushed sugar are rather dearer.

The stock of sugar in the United Kingdom on the 21st ultimo was about 11,000 tons in excess of that held at the same date last year.

September is a critical month for the beet crop, and more unfavourable reports of it recently have caused beet sugar for October and November delivery to be rather firmer. Still there is every reason to expect a very large beet crop, and we anticipate easier rather than higher prices for some time to come.

The Market closes with rather better feeling all round, but without much life.

Present quotations of the standard qualities are as under :—  
Porto-Rico fair to good refining, 21s. to 21s. 6d., against 21s., to 22s.; good to fine grocery, 22s. 6d. to 24s. 6d., against 23s. to 25s.; Martinique crystals, 26s. 6d. to 27s. 6d., against 27s. to 27s. 6d.; No. 12 Havana, 23s. to 23s. 6d., against 23s. to 23s. 6d.; fair to good refining Cuba Muscovados, 21s. to 21s. 6d., against 21s. to 21s. 6d.; middling to good brown Bahia, 18s. to 19s., against 18s. 6d. to 19s.; good to fine Pernambuco, 19s. to 20s. against 19s. to 20s.; Paris loaves, 27s. 6d. to 28s. 3d., against 27s. 9d. to 28s. 6d.

# THE SUGAR CANE.


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 The writers alone are responsible for their statements.

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## HOLLAND AND THE CONVENTION.

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The *New Rotterdam Courant*, a paper said to possess sufficient influence to over-ride that of the refiners, has taken up the sugar question in a manner very favourable to our interests, and tending to encourage hopes of a satisfactory arrangement. Beginning at the rudiments of the subject, it points out that neither a uniform duty nor a multiplication of the classes would be a sufficient reform, and that analysis—saccharimetry as they call it in France—would be equally defective. In proportion as this system appeared more difficult and inaccurate, so refining in bond increased in favour. At the same time, the writer admits, the refiners in France and Holland saw clearly that refining in bond would deprive them effectually of their bounty. But, he adds, the public would most assuredly prefer that the bounty should be thoroughly abolished by the adoption of this system, if it could be shown to be practicable. Going into the history of the negotiations, the writer describes how, in 1876 and 1877, the Dutch Delegates, Messrs. Rahusen and Toe Water, supported refining in bond. They then insisted that no complicated system was necessary—the quantities going into consumption being all that was required to be known. The question was, could evasion of duty be prevented? This they unhesitatingly answered in the affirmative; while the French, on the other hand, maintained that a preliminary *charge*



for duty on the raw sugar was a necessary precaution. This the Dutch did not object to, so long as it was only for curiosity and as a check; but they would not admit the *levying* of a preliminary duty on the raw sugar. The writer explains how they saw that the supervision should be strong at exit, not at entry; and that a preliminary duty, by securing a minimum, would weaken the subsequent supervision. On this point the English supported them warmly, showing how saccharimetry would give a most uncertain basis for this preliminary duty, and how there would consequently be excess yields which, owing to the weakened control, would not be discovered. The refiner would make more sugar than appeared on his debit account, while the tendency would be to be satisfied with the debit amount. It was, in fact, admitted by the French Delegate himself that with a preliminary duty a strict control would no longer be necessary; and when M. Toe Water described the Dutch regulations,—bars for windows and so forth—he did not approve. The French, in wanting a preliminary duty, wished to appear very zealous for their Treasury. But, adds the *New Rotterdam Courant*, “we believe their system is intended to keep the door open for their refiners, with the connivance of their Government.”

The article continues by pointing out that England's only interest now being to obtain absolute suppression of protection, her support of the Dutch system is the best guarantee of its efficiency. Moreover, the writer adds, the Dutch Government must really be quite satisfied with the system proposed by its Delegates, which may, in fact, be taken to be that of the Government, since M. Toe Water left Paris for the Hague in the midst of the sittings of the Conference. Its principle is that duty be paid only on what goes into consumption. The project of Convention did good service by securing from France the admission that sugar for export should not be subject to the preliminary charge for duty. The article concludes by asking why we have heard no more of this Convention. “Since we cannot abolish the duty, why not have a sound system?”

Subsequently, the *New Rotterdam Courant* has published a trans-

lation of the letter addressed by the Secretary of our Sugar Refiners' Committee to the *Times*, describing the recent extraordinary conduct of the Dutch Government in reference to the Convention, prefacing it with the wish that nothing may be done which should injure the good name of Dutch diplomacy.

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## FOREIGN SUGAR BOUNTIES.

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### MEETING IN CITY HALL, GLASGOW.

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A public meeting was held last night in the City Hall for the purpose of protesting against the foreign sugar bounties. Dr. Charles Cameron, M.P., [presided, and on the platform were Messrs. James Stewart, M.P., Greenock; Duncan Kennedy, S. Peters (Bristol), John Battersby, John M'Lean, T. M. Kelly (Bristol), James Barr, George Jones (London). Letters of apology were read—one from the Lord Provost was in these terms:—

Glasgow, October 16th, 1878.

Dr. Charles Cameron, M.P.,

My Dear Sir,—I regret I am not able to be present at the meeting in the City Hall to-morrow night on the Sugar Bounties Question. There can be no doubt that the system of bounty is vicious in principle, and unfortunately it inflicts a great injustice on all those connected with the industry in this country. The remedy for this state of things is, however, a difficult question to solve. I am only astonished that the French Government have been able to continue a system so injurious to that country at large for so long as they have done, as it is simply a taxing of their own people to the amount of the bounty for the benefit of the consumers in this country, although at the same time, it must be allowed, it brings ruin to the British manufacturer. I do not think that this country would consent to a retaliatory tariff, although I sympathise very much indeed both with the labourer and the capitalist who are suffering from the existing

state of things; and I think we ought to bring the greatest pressure we can upon our own Government, with the view of their making strong representations to the French Government on this question. The advantage to the British consumer by the introduction of French beetroot sugar is more apparent than real, as the saccharine property is well known to be below that of cane sugar, and this fact ought to be prominently kept before the public. I trust that public attention being directed to the twofold aspect of the question, may lead, ere long, to the removal of the hardship under which one of our leading industries is so grievously suffering.

Yours faithfully,

WM. COLLINS.

Mr. Duncan McLaren, M.P., Mr. Stephen Mason, and Sir James Bain, also wrote condemning the bounty system.

Dr. CAMERON, M.P., said—The question we are met to-night to discuss concerns not only those immediately engaged in the business of sugar refining, but it involves a question of policy, which intimately concerns the general public. So far as regards them the question simply is whether for the sake of a trifling and temporary rebate upon our sugar prices, which is certain at no distant date to be exacted from us with usurious interest—whether for this trifling and temporary advantage it is prudent to permit by artificial means the rapid extinction of an industry which will leave us at the mercy of a foreign monopoly and the financial exigencies of the country which has bribed away our trade. What, then, is the system of which we complain? The sugar trade is a trade the prosperity of which concerns interests spreading far and wide. It implies a gain to the agriculturist whether he cultivates beetroot or sugar-cane. It affords work for the shipowner and the carrier. It gives employment to a large amount of capital and labour in the factory and refinery, and it furnishes an important article of export. For this reason one nation has vied with another to secure the largest possible share of the sugar trade. Before statesmen have mastered the fundamental truths of political

economy—before they have learned that protection and bounties mean the taxation of the many for the benefit of the few—protection and bounties present themselves to them as the most obvious methods of fostering a trade, and to these methods the various nations competing for the sugar trade naturally had recourse. We were at one time no better informed than our neighbours, and fell into both these errors. We have, however, long since grown wiser and discarded the one and the other. The result has been that, allowed to run in natural channels, and forced to rely on its own resources, the sugar trade of this country has acquired a vigour and a robustness without which it would years ago have been compelled to succumb to the pressure to which it has been subjected. (Cheers.) On an equal platform no nation, I believe, could compete with us. (Cheers.) In the natural strength of the British trade the nation has its best and only guarantee for a continuance of cheap sugar. (Cheers.) The question is—Shall we allow that guarantee to be taken from us, and for a few years enjoyment of a slightly cheaper article, leave ourselves at the mercy of a foreign competitor, who would certainly not sow his silver broadcast among us if he did not expect to reap a harvest of gold. (Cheers.) But the system of sugar bounties is not a thing of yesterday. How comes it, then, that if our trade has survived them for so many years, they can now threaten it with extinction? I believe that the answer is—that we can stand a certain amount of handicapping. If there were no handicapping we may assume, for foreign governments act upon the assumption, that our refiners could drive foreign products out of the world's market. Against a certain amount of handicapping we can and did for many years hold our own. But since the French war our industry has been too heavily weighted. We can perhaps hold our own as we held our own against a bounty of 30s. or £2 per ton; but when you come to put a half as much again, it is too much for us. That for so many years we were able successfully to compete against this lesser bounty proves what I have said, that in the permanence of our own

trade lies our true guarantee for a continuance of cheap sugar. (Cheers.) I may at once explain that though various countries grant bounties on sugar—France, Holland, Belgium, Austria, and Italy—(Germany categorically denies that she grants any bounty on export)—I say although all these countries grant bounties on exported sugar, it is only with the case of France that we need to-night concern ourselves. For, owing to the financial embarrassment into which she was plunged by the recent war, her bounties it is which have been increased beyond the point of endurance—her bounties it is which threaten to swallow up not merely your sugar trade, but that of all her smaller bounty-giving fellow-sinners along with it. (Cheers.) But how, you will ask, comes it that the financial embarrassment of France caused her to increase her sugar bounties, when it should have had precisely the contrary effect. The explanation is that these bounties are not given avowedly and openly as bounties to the foreign sugar refiner. He is not handed openly and honestly fifty shillings or three pounds on every ton of refined sugar which he exports. What is done is this. The raw sugars are taxed according to the amount of pure saccharine matter which they are supposed to contain, and a drawback is given on the export of that amount of refined sugar equivalent to the duty previously charged. A ton of a certain raw sugar, for example, is estimated to yield 16 cwt. of refined sugar, and is charged, say, £24 duty; but on the refiner exporting 16 cwt. of refined sugar he receives back the £24 paid. This would be perfectly fair were it possible to ascertain the true effective richness of every raw sugar, and to tax it accordingly. But that is not practicable, and what is done is to divide raw sugars into certain classes according to their grain, colour, and appearance, and to say that the first class should yield so much refined sugar, the second so much less, and the third so much less again, and to levy the duty accordingly, intermediate types being taxed at the rate of the class immediately below them. Now, under such a system it is clear that the endeavours of the manufacturer of the raw material will be directed to evade the

duty as much as possible by getting in his produce as near as possible in point of richness to class number one, but not quite up to it, so that it may be taxed as class number two. The refiner working with such an article can obviously make out of it more than the amount of refined sugar estimated, and can consequently recover on export more than the amount of duty paid—in other words, he can obtain a certain bounty. This would be the case were the effective richness of the various classes of raw sugars fully and fairly assessed, and were no ingenuity exerted to disguise their richness. But it has been conclusively shown by the International Commission of Chemists appointed under the Sugar Convention of 1864 that the amount of pure sugar in the different classes of raw is largely underestimated, and it is notorious that various tricks are resorted to for the purpose of disguising the natural richness of raw sugars, and getting them in at the lowest rate of duty. All this has, of course, the effect of increasing the bounty. Now let us suppose that, as was the case before the war in France, and as is still the case in some of the other countries on the Continent, the pure sugar was taxed £1 per cwt. A refiner buys a ton of a sugar taxed as containing 16 cwt. of refinable sugar, and has to pay £16 in the shape of duty. He can, however, easily extract from it, say, 18 cwt. of refined sugar, on which, if he exports it, he will receive a drawback of £18, or £2 more than he paid. (Cheers.) But after the Franco-Prussian war the Government of France was obliged to increase taxation right and left, and at one stroke they added 50 per cent. to the sugar duties. The result is that the refiner in the same operation as I have just described instead of paying £16 per ton as duty and getting back £18, now pays £24 and gets back £27. In other words his bounty consists in a percentage on the duty levied, and the higher the duty the greater the bounty. (Cheers.) The duty in France being now half as much again as before the war, the bounty is consequently 50 per cent. higher. (Cheers.) It is this extra 50 per cent. which threatens to put an end to our sugar trade. A bounty of £2 per ton we managed to compete against. Three

pounds has proved too much. One of our refiners after another has succumbed, and the extinction of our sugar trade is only a question of time. (Cheers.) And now let us see what is the cost of this system to France. Four years ago her Finance Minister set it down at £800,000 a year. Since then the trade has been progressing, and it can hardly now be less than £1,000,000 per annum. (Cheers.) This money of course has all to come out of the pockets of the general taxpayer. He is getting very impatient under his burden, and would have got rid of it long ago but for the diplomacy and passive resistance of the sugar industries. The visible results of his lavish expenditure during the past six or seven years, the speedy prospect of driving us out of the market and securing our trade for France, may reconcile him to endure the drain a little longer; but the moment that object is attained down will go bounty, and we shall have to buy our sugar from France at natural French prices. (Cheers.) That naturally their prices are higher than ours is shown by the fact that for many years our refiners competed successfully with France, in spite of her bounty of 30s. to 40s. per ton. What then is the present gain to the British public of this million sterling per annum which France spends in forcing her refined sugars upon us? I should say certainly not half-a-million. The other half at least is spent in bridging over the difference which exists between our natural prices and hers. Well, how does the bounty affect the individual consumer. It is found that, owing to the bounty, French refined sugar is sold in London from 50s. to £3 per ton cheaper than, allowing for duty, it can be bought in Paris. £2 10s. to £3 per ton is the practical measure therefore of the bounty paid by France. If half of that goes in bridging over the natural difference in prices between the refined sugars of the two countries, the temporary gain to the British consumer will be from 25s. to 30s. per ton, or somewhere about half a farthing per pound. (Cheers.) Well, it may be said half a farthing is always something, and so it is, but certainly not much to the class who use refined sugar. In arguing this

question, I have seen it asserted that the bounty gain, whatever it is, goes into the pocket of the workingman. So some of it doubtless does, but it must be a very small fraction indeed. Of every ten lbs of sugar consumed in this country, nine are unrefined. Practically, on the tenth pound alone is any bounty paid. Austria, indeed, has taken to paying bounties on the export of raw sugar, but the amount of her sugars which finds its way here is a mere bagatelle. The question that has been before the public for so long—the question which has given rise to all the agitation of the past ten years relates solely to the bounties on the refined article, and in 1876 the amount of refined sugar consumed in the United Kingdom per head of the population was 8½lbs. If, then, I am correct in my calculation, the result of the French bounty is to effect an average saving of one penny and half a farthing per annum per head of our population. (Laughter and cheers.) That is the average, and of course every man will not save his penny and half farthing. The working man uses raw sugar almost exclusively, and the average annual saving of his class per head will probably not amount to the odd half farthing. What are the sufferings and loss inflicted on the working classes by the destruction of our sugar industry I leave to the other speakers to explain. I think that I have shown, however, that we can afford to approach a discussion of the abstract bearings of the question without any fear of the consequences of a decision one way or other so far as the purse of the consumer is concerned. Coming now to the practical point, the question presents itself whether we should take steps to get rid of these bounties, and, if so, what steps we are justified in taking? (Cheers.) I have never heard any one dispute the abstract desirability of putting an end to the bounty system—a circumstance which strikes me as strange; for it seems to me that if you concede the desirability of putting an end to it you concede everything. (Cheers.) If it is desirable to put an end to it—if it is desirable to prevent other nations from spending a million a year for the purpose of



cheapening our sugar—it must be because the way in which the cheapening is accomplished is injurious to Great Britain, because the ultimate and indirect loss to the consumer more than counter-balances any immediate gain. If this be once admitted it seems to me that we are justified not merely in advocating the discontinuance of the bounty system, but in actively defending ourselves against it. But is it agreed that the system is a pernicious one? Have we consistently tried to bring the system to an end? Indisputably. During the past fifteen years various statesmen and different parties have been in power in this country, but the policy which we have adopted has never once changed. (Cheers.) In 1862 we entered into negotiation with France, Belgium, and Holland for the suppression of the sugar bounties, and the result was the Convention of 1864. That Convention was neither more nor less than a treaty by which the four countries bound themselves to put an end to their bounties, and to do away with differential duties as between themselves. For 10 years this treaty remained in force, but France, on one pretext or another, not only evaded her obligations, but increased her bounties and her *surtaxes*. (Cheers.) This recalcitrancy on the part of France led to innumerable conferences and endless despatches, but our policy never wavered. It was the same at the Conferences of the Hague in 1868 and 1869. It was unchanged at the London Conferences of 1872 and 1873. It was identical at Brussels in 1874, and Paris in 1877. From first to last our object was to get these bounties abolished. Why, then, have we so persistently urged their abolition? Because it has been the belief of every Minister who controlled our policy that these bounties were detrimental to Great Britain. (Cheers.) If this be the case, I confess that I can see no reason why we should continue to see ourselves injured without raising a finger in our own defence. (Cheers.) We have the means in our own hands. We have only to intercept the bounty before allowing bounty-fed sugar to enter this country, and the thing is done. (Cheers.) I know that at a preliminary discussion which

took place among the promoters of this meeting it was agreed to leave the question of a countervailing duty an open one, and I know that the resolutions have been framed with that object. In speaking on this point, therefore, I must carefully explain that I am speaking my own sentiments only when I say that a countervailing duty appears to me the only means of bringing the question to a prompt and successful issue. (Loud cheers.) Remonstrances and diplomacy have been exhausted in vain. The question is one that presses, and fifteen years is quite enough to spend in Conferences and despatch-writing. (Cheers.) The time has come, it seems to me, when we may fairly say to France and her competitors for our trade—You must give up these bounties. You may do so either by refining in bond or by arranging your drawbacks so that they shall exactly tally with your duties, as you undertook to do in 1864. You may effect this object as you like; but if you don't, we shall ascertain exactly what your respective bounties are, and tax your bounty-fed sugars accordingly. (Cheers.) But we are told that the imposition of such a duty would be subversive of the principles of free trade. (Hear, hear.) It might be subversive of the fetish free trade, which many men blindly worship—(cheers)—but it would be in exact accordance with the fundamental principle on which the whole theory of free trade is based. (Cheers.) The fundamental principle of free trade is to conduct our commerce on such a basis as shall be productive of the greatest amount of permanent good to the community. Is it for the permanent good of the community that these bounties should be continued? (A voice, "Certainly not.") The unswerving policy of Britain for the past 15 years replies emphatically, No. To conduct our commerce with the maximum of permanent benefit to the commonwealth every free trader admits—and I as a free trader most readily admit—there must be no talk of protection or conditional reciprocity. I ask for neither trade protection, nor trade reciprocity, I ask for trade preservation, which is a very different thing. (Cheers.) If I demanded protection, I should ask for the imposition of

such a duty as would keep foreign sugars out of our market. France sends us many thousands of tons of unrefined beet sugar, which competes with British produce. But it carries no bounty, and we don't complain of it. If I desired reciprocity I should say, Let France take off her differential duty against our sugars, or we will impose a differential rate against hers. I ask for neither of these things. If I could believe the bounty system permanent I should say that it was so much gain, and that it was better for us to profit by it than waste our energies in producing what we cannot produce so cheaply as we can buy. But no sane man can imagine that the system can be permanent. It has been emphatically condemned by the French Assembly, and is only continued owing to the *finesse* of the refiners. Every change in the course of trade is accompanied by temporary suffering and individual loss. Where these are counterbalanced by a permanent general gain I should be the last to interfere. But here the gain is fugitive, the loss will be permanent. We ask the Government to preserve us against that loss. In the course of the discussions on the sugar bounties many false analogies have been started. We have been asked, for example, whether because the United States interposes a prohibitive tariff against our manufactures, we should retaliate against hers. Certainly not; but the question has no more to do with the proposal of a countervailing duty to neutralise the sugar bounties than it has to do with squaring the circle. If you want to know what is done in a really analogous case look at the tobacco trade. The tobacco manufacturer like the sugar refiner deals with a raw material which he has to import. Now a hundred pounds of tobacco leaf will not make a hundred pounds of cigars. There is a very considerable waste in the process of manufacture—a waste amounting to somewhere about 33 per cent. The British manufacturer has to incur this waste in the form of an expensive material on which he has paid a heavy duty. The foreign manufacturer on the other hand has the same amount of waste to encounter, but in his case the material wasted is cheaper, both by the cost of freight and the

amount of duty. Of the amount of freight our Government properly takes no cognisance. It is a natural advantage, quite as much as is the cheapness of foreign labour. But so far as the saving of duty is concerned that would be as unfair and an artificial advantage. It is evident that if the foreign manufacturer were allowed to send his cigars to Great Britain at the same rate of duty as unmanufactured tobacco, he would only pay on them 3s. 6d. per pound, while the British manufacturer requiring to use nearly 1½lbs. of raw tobacco to produce one pound of cigars would have to pay 5s. 2d. in the shape of duty. In other words an artificial bounty of 1s. 10d. per lb. would arise in favour of the foreign manufacturer—a bounty which would speedily drive our tobacco industry out of existence. How do we meet the difficulty? By doing precisely what has been proposed in the shape of the sugar bounties, by levying a countervailing duty on manufactured tobacco—(cheers)—a duty calculated not to give the British manufacturer the slightest advantage—that has been most carefully avoided—but calculated to neutralise the artificial bounty which would otherwise speedily put an end to his existence. Our tobacco duties were adjusted some years ago when Mr. Gladstone—(cheers)—was Chancellor of the Exchequer. They were revised last year by the present Conservative Government, and the same principle was adopted on both occasions. The question was fully discussed on each occasion, but no one, so far as I am aware, ever thought of suggesting that this countervailing duty was in any way antagonistic to the principles of free trade. (Cheers.) As a matter of fact it is not in the least antagonistic to them. The policy which dictated its imposition was a policy not of trade protection nor of trade reciprocity, but of trade preservation. The principle which justified it is the same as would justify a countervailing duty against bounty-fed sugar. And in suggesting that method of bringing to a certain and speedy issue our negotiations of the past fifteen years, I am suggesting no more than that the sugar refiners of Great Britain deserve as well of their country as her cigar manufacturers, and that the same

precautions should be adopted in the one case as in the other to preserve a trade from extermination. (Loud and prolonged cheers.)

Mr. DUNCAN KENNEDY, Secretary of the Trades' Council, moved:—"That in the opinion of this meeting the doctrines of Free Trade require that all competition should proceed upon the basis of relative natural advantages, thereby securing to consumers the lowest natural price approximating to the lowest natural cost of production. But the bounties given or obtained on exports of raw beet or refined sugar to this country from France, Holland, Belgium, Austria, Germany, and Russia, operate upon the English sugar market so as to prevent competition on the Free Trade basis of natural advantages, and thereby deprive English producers of their right to Free Trade competition in their own markets, inflicting upon them the necessity of withdrawing from the unjust competition, or of giving out of their own *profits and wages* the equivalent of the foreign bounty."

Mr. S. PETERS, of Bristol, seconded the motion in an effective speech, in the course of which he said: The City of Glasgow, some people said, was not much affected by the bounty system, but he might tell them there were hundreds of thousands of pounds worth of material exported from Glasgow to the West India Islands, and if we did not purchase our sugar in the West Indies they could not buy from us the commodities that were manufactured in this country.

Mr. JOHN McCULLOCK rose from one of the front seats and asked whether that was the proper time to move an amendment, when it was ruled that Mr. Kelly should first speak in support of the resolution.

Mr. KELLY (Bristol) gave statistics of some of the goods which our declining West Indian colonies had purchased from this country. In 1877, they purchased woollen goods to the value of £326,745; cotton goods to the value of £472,848; boots and shoes, £121,959; machinery, £143,291; soap, £91,000; and locomotives, £99,000—making a total of £1,264,823, a great proportion of which was spent upon the employment of British labour in every department. (Cheers.) They should look upon the question as one of bread and cheese. The class he was connected with regarded it in that way, and whether that bounty was repealed by Whig or Tory, they would accept the repeal with thanks. (Cheers.) The speech of the chairman did thorough justice to the whole question, and in the West Indies, as well as in this country, it would be heralded as the outspoken declaration of a thorough Liberal and a thorough free trader. (Cheers.)

Mr. JOHN McCULLOCK said that the question was important because those who took part in this movement were placing Free Trade upon its trial.

(Hear, hear, and "No.") He moved an amendment—"That inasmuch as the remission of taxes on the sugar imported from France to this country is on the whole highly beneficial to the mass of the people, though perhaps hurtful to the few who are directly engaged in the trade, we therefore resolve that it shall receive no further opposition, as all such action would be in complete conflict with the accepted principles of Free Trade." He held that countervailing taxes were just the old obnoxious principles of protection—(hear, hear, and "No")—sought to be introduced under a disguise. (Applause.) He hoped they would not take up his time for a moment with applause. (Great laughter, and a voice, "A Frenchman in disguise.") He was a Free Trader and a trades' unionist, and he thought that should command a hearing. It appeared to him that this was trades' unionism and free trade in conflict. If the iron trade, for instance, greatly afflicted by the introduction of locomotives from Belgium, had rushed before the public in the manner in which the sugar trades had done, they would have done what was equivalent to a condemnation of free trade. If trades' unionism was to come into conflict with free trade, let it be openly declared. Why, trades in other countries had the same complaint to make of us as the sugar refiners had to make of France. If they proceeded upon the principles of free trade, then they would find that this grievance was just an illustration of the greatest good to the greatest number with suffering to a few. In the Island of Dogs shipbuilding was carried on extensively, but the wages of workmen were high, and the consequence was that as wages were low in Scotland trade left the Thames and settled on the Clyde. (A voice—"We gave no bounties," and another voice—"Commissions.") If they wanted to hear about commissions they had better inquire at the Clyde Trust. He wished to show the principle of free trade—namely, that those who required to purchase an article would do so in the cheapest market. With regard to those sugar duties, as Mr. George Anderson had said, if the French were willing to give us one million of pounds in a present we should just accept it. While he made that remark he sympathised with those men who were afflicted by the changed nature of their trade; but if we were to go on to stop the introduction of a cheaper class of goods because they came from foreigners we would be knocking upon the head of free trade. The question was simply this, whether or not the whole country was to be deprived of the greatest amount of benefit they could receive from a foreign nation because several hundreds of men in this country might suffer.

Mr. J. B. FORSTER, a West Indian Planter, said that what was wanted was abundance of sugar, no matter whether it came from France or from the West Indies, and if there was any fiscal law the operation of which had a tendency to reduce the quantity of sugar that was supplied to the country it was a law which was adverse to the principles of Free Trade.

(Hisses and applause.) The question of the operation of the French bounties was one which was of far more importance to growers of beet and cane sugar than to the sugar refiners of Greenock. The French refiner, everybody admitted, got a large bounty, which enabled him to undersell the English refiner, whose only protection was in giving less for his raw sugar. As soon as the raw sugar market fell in England, that acted on the raw beetroot sugar market in France, and it fell. The French refiner then took another step and reduced the price further, and the thing went on continuously in that way until the price of raw sugar was reduced to such an extent that it was found impossible to grow it. As a planter, he knew that the great question had been with many, as with him, whether or not to abandon estates and allow them to grow into bush. If this course was forced on planters many thousand tons of sugar would be taken out of the market, and the price of sugar would thus be affected. If there was something at work to convert well cultivated cane fields into deserts it meant a diminution of the quantity of sugar, upon which cheapness depended. (Applause.) It was all very well to say that places that might be closed in this way would be reopened when prices got better. Nothing of the kind would occur. It required a great many years to bring an uncultivated estate into a state of cultivation again. There had been a manifest violation of Free Trade principles on the part of France, and he could tell them this, that if they were to lay it down as a positive law that they would never resist such action as that of France. France and the world might laugh in the face of Britain as to going to war. There would be no real need to go to war—a much cheaper thing would be to destroy our industries by introducing bounties. The question was a question of quantity, and the question of quantity was the question of price, and it was not to the interest of this country to receive a present of a million of pounds on any such pretence as that given in this case. (Applause.)

Mr. WM. B. MATTHEWSON seconded the amendment.

On a show of hands being taken, the motion was carried by an overwhelming majority.

Mr. JOHN BATTERSBY moved the second resolution as follows:—"That we, 'Citizens of Glasgow,' in public meeting assembled, request that the Government should take such steps as will in the interests of this country tend to bring about a fair and honest competition in regard to this foreign sugar bounty system. And further we are of opinion that the most fair and legitimate means is by urging on these foreign Powers the entire necessity of refining in bond, as the only means whereby we can have fair and honest competition." Mr. Battersby denounced the doctrine of benefitting the few at the expense of the many. He had no sympathy, he said, with the proposal to establish a countervailing duty. If that duty was put on

the French might increase the bounty, and where then would be the countervailing duty? (A Voice, "Increase it, too.") It appeared to him that if the system of refining in bond was adopted the French sugar refiner would have no drawback, and in the absence of any drawback we might be able to run our French neighbours out of the market, as they had tried to run us (Applause.)

Mr. JOHN MACLEAN, Greenock, seconded the motion.

Mr. STEWART, M.P. for Greenock, supported the resolution. He said it was admitted that the British sugar refining interest was subjected to a most unfair competition—(hear, hear)—though it seemed there were some in the hall who took exception to that—and that anything like unfair competition could not exist on the true principles of Free Trade. (Hear, hear.) He thought if there was any industry in the country—no matter what the industry was—which was subjected to a system of unfair competition by the action of foreign Governments, then it was the duty of every genuine free trader to do everything he possibly could by every legitimate means to remove the grievance. (Hear, hear.) The sugar refining interests in Great Britain was just now exactly one of these cases. It was a totally different case from that which had been mentioned of the Belgian locomotives. If the Belgian locomotives had had bounties placed upon them in order to introduce them into this country, that would have been an analogous case; but there was nothing of the kind. They could not compel foreign nations to adopt Free Trade; they could not force them to place prohibitive duties upon our exports; but that was a totally different thing from upsetting the natural course of trade by the provision of bounties. On behalf of the sugar refiners of Greenock he had to thank the chairman for the extremely lucid way in which he had stated their case. (Applause.) But every one might not see his way to go quite the length the chairman had done in regard to placing countervailing duties on sugar, and therefore it was wise on the part of the committee who had drawn up the resolutions to have avoided that, and to have gone merely the length of proposing that the Government should use all their efforts to bring foreign Governments to refine in bond as that would unquestionably be a far more pleasant solution of the difficulty. He did not despair of their being yet able to do that. In his opinion there was another reason why they should not go further at present. The French Treaty required to be revised during the ensuing year, and that would give the Government an excellent opportunity to have everything that seemed to be injurious to British commerce put right; and he was quite sure that the Government would place this sugar question in the forefront of their negotiations. (Applause.)

Mr. JAMES ADAMS said he wished to propose an addition to the resolution. He perfectly agreed with the chairman that nothing short of a countervailing



duty would mend this difficult matter. Negotiations had been tried frequently and without success. He would not be mealy-mouthed about the matter at all. If free trade was to destroy the interests of labour and of capital in this country he would say, "Away with it." (Applause.) He was a free-trader in the broadest sense, but not in the chairman's sense. The chairman said he did not want reciprocity. He did not understand upon what principle there could be free trade where there was no reciprocity. (Laughter.) That was Irish reciprocity. (Renewed laughter.) The chairman said he would not even ask them to remove the duty they placed upon the sugar sent out from this country for the purpose of being imported into France. Why should they allow the French sugar-refiners to send their commodities into this country duty free if the French would not allow us the same privilege? Did they call that free trade? (Hear, hear, and "No.") Mr. Adam concluded by proposing the following addition to the resolution:—"But that, should diplomatic efforts prove abortive, recourse be had to a countervailing tariff." (Applause.)

The CHAIRMAN put it to the meeting whether the addition should be added to the resolution, and the affirmative was carried by a majority. The resolution as amended was then put to the meeting and adopted.

On the motion of Mr. JAS. BARR, seconded by Mr. JONES, London, it was unanimously agreed—"That copies of the foregoing resolutions be signed by the chairman of this meeting and at once transmitted to Sir Stafford Northcote, the Right Hon. W. E. Gladstone, and to the Finance Ministers of the various Powers granting bounties on sugar exports."

A vote of thanks was then passed to Dr. Cameron for presiding, and the proceedings terminated.

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## IMPROPER LIMING OF CANE JUICE.

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### CLAIM FOR ANOTHER CLARIFYING AGENT.

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*A continuation from page 216.*

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The long-continued excessive rains now visiting "this neck of woods," have for the time being suspended the work of "laying-by." Time is allowed me at last to answer an inquiry flatteringly made, through your columns, by "W. W. P.," in reply to notes of mine on "Treatment of Frosted Cane Juice," &c., &c., which you published in February or March last. The inquiry of "W. W. P." is headed "Give Us More Light."

The articles written by me at that time were necessarily hurried, and had in view but one object, which was to combat, as far as possible, the wide-spread demoralization and panic into which the disasters to the sugar crop of last year had apparently thrown all parties who are interested, directly or indirectly, in Louisiana sugar plantations. I thought that a few facts, taken from the log-book of an "old salt," might help at least some of those who were so evidently "at sea." Like Simon Suggs, I had been "all along thar," and had paid dearly for a fair share of experience which necessity made practical and accident made valuable—to me at least. I was early in life forced to become my own sugar-maker or to give up the business, to succeed where others had failed, where the best sugar-makers had said—"It is impossible, sir; this land of yours will not make good sugar." I had to read many accepted authorities, and then to do my own thinking, stirring, and testing. With but limited knowledge of chemistry, and without any such information as would enable me to analyze any scientific subject, I had to submit theory to the alembic of actual test, and discard all that would not "pan out" tangible benefit. All I know now to be a fact "worth knowing" is, that there is a great deal yet to be learned about sugar culture and sugar making.

Conceiving it to be a very dangerous thing for anyone claiming the benefit of long experience in matters of vital importance to others to write one word which is capable of misconstruction or liable to be misunderstood, I would refrain from entering into the details of a formula which I could not practically illustrate to the eyes of the inquirer. I have not admired that style of man, even when I found him in the pulpit, who was ever ready to tell his neighbour what he must not do to escape destruction, but ever unable to give even a plain hint as to the road which leads to salvation. I don't want anything "*aliunde*" when I start to "read my title clear."

There is a point sought to be made in "giving in my experience" to you last winter, on which (as I was aware at the time) I was not sufficiently explicit. It is difficult to enlarge upon, or concen-

trate upon, that point without making it so pointed as to prick some of what are called "established principles," or rather their advocates. The sugar-maker of the old school—of the olden time—would get right out of his grave to-day to fight me if I dared intimate more plainly than I did in former letters that lime (which everybody uses, and which "W. W. P." and which I must continue to use until "gelatinous alumina" or something else shall have been discovered as a substitute) destroys more sugar than it makes. If any one thing has been made plain to my vision, for twenty years past, it is the fact that lime, carelessly handled, has been the author of more mischief than came from any other one cause. For more than twenty years I have been longing for an agent that would entirely supplant lime in the manufacture of sugar. Why? Because I cannot to-day say, after having carried litmus and turmeric papers as assistants in twenty-seven crops, that I am sure that I ever had an exact "lime-point." I have been made so well aware that the precise point at which lime causes to do good and begins to do evil is a point beyond the ken of the sugar-maker, or of his test papers, that I have but one rule to govern me in the matter, and that is to guard against using the least bit beyond the point it must be used to produce a certain amount of good. The inference is that I have made a great deal of sugar which had not enough of lime in it. So I have; but I have made a great deal more which had entirely too much lime in it, and I did not know it until I saw how much invert sugar a little more lime had made. I call it erring on the safe side to stop short of that lime-point and that boiling-point at which it would begin to make invert sugar. Does "W. W. P." ask me to tell him where that point is? I have candidly acknowledged to him that I have never found it; but I can tell him that, just so surely as he limes his juice to that point at which his litmus paper shows the absence of all acid, just so surely he will have begun to invert his sugar. Therefore, I said, in one of my letters, that you must carry your juice and syrups, "a little acid" all the way through. I aim, it is true, to so use lime and so boil as, after all evaporation shall have ceased, to have a perfectly neutral compound, so far as acid and

alkali are concerned. Now, then, so far as you can see from ordinary tests for acids and their bases, you may have succeeded in having a neutral product, but can you be sure that the caustic principle of lime is not making invert sugar out of your cold sugar? Here is where the polariscope will help you to know what you have done, and I will advise you to look early to prevent a recurrence of mistakes. Do you ask me to specify some means of salvation—to tell you what you can safely do? I can only tell you, “err on the safe side”—can tell you, only, that when your litmus papers show you that your acid is rapidly vanishing, invert sugar is not far off—will only add that this is especially the case with frosted cane juice, to which active doses of lime are rapidly fatal.

I am well aware that in saying what I do I am jarring against the “fixed opinions” of many practical men, and know full well that the men are not at all dead yet who believe that you cannot make a pound of sugar without (about) a pound of lime. I also know—we all know—that some juice will take, without injury, an infinitely larger quantity of lime than other juice will take, and no one will gainsay the assertion that cane juice, impregnated with sulphurous acid gas, will take greatly more lime than juice not treated by sulphur will take. But I contend that lime, in any quantity, whilst it is necessary to produce absolutely necessary results, is an injury to all juice, however treated, and particularly so when raw lime is placed in immediate contact with the juice.

“W. W. P.” will ask, “Is there no remedy for this? Is there no balm in Gilead?” I say, “Yes, there is.” I say that lime can be shorn of its sting; that it may be so used that it will leave no sting behind. Moreover, if “W. W. P.” desires me to do so, I will send him one barrel of a “preparation” which will enable him to dispense almost entirely with the use of lime, and give him a much better clarification and better sugar than lime will produce for him. This preparation is something I have been trying for many years to procure, and am indebted now to a practical chemist and refiner of New York for my ability to say “Eureka.” It is a preparation easily and cheaply made on any plantation where steam is used, and I am satisfied that it will be in demand for every plan-

tation in this State, when its effect upon this crop will have been known. I will give many an opportunity to test its merits, and will only ask them, when fully satisfied of its efficacy, to pay a trifling royalty to my friend, the inventor.

There is another point on which I should like to answer "W. W. P.," but that would be going backwards and far away from the conclusion of this already too long communication. That point is as to the length of time to which cane juice should be subjected to the action of sulphurous acid gas. My experience leads me to differ widely from many who have written upon this subject. Some other rainy day I may ask you for space on this head, and to express my opinion as to why some people do not succeed in obtaining sugar from well-windrowed cane.

DAVID KER.

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#### EFFINGHAM CENTRAL SUGAR MILL CO., NATAL.

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##### *Extracts from Reports of Managing Director.*

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July 8.—*Buildings and Machinery* have been completed in a most satisfactory manner. A trial of the boiler on the 26th ult. resulted most satisfactorily. The whole works were ready to have been started on the 1st inst. Full report of opening on 3rd inst. in *Natal Mercury* (already sent to you).

July 13.—We had to suspend crushing for a week for a few trifling alterations, but are ready to commence again.

*Yield.*—The first crushing was from  $2\frac{3}{4}$  acres of cane—by no means the finest—the yield was nearly  $8\frac{1}{2}$  tons, quite 3 tons an acre.

*Frost.*—About 70 acres have been affected of this season's crop, but as we are ready to crush at once, we trust there will be no serious deficiency. The frost has been more severe than has been known for ten years, and has risen higher up the hills.

July 22.—We are crushing every day and getting rather more than 4 tons per diem.

Aug. 5.—*Machinery* is working very satisfactorily and turning out fully 5 tons per diem.

Aug. 17.—The *yield* from the 30 acres of *frosted* cane (already crushed) barely exceeded an average of 2 tons per acre.

*Steam Conductor and Ventilators*.—It was found necessary to construct something to take off the steam which rose from the trays, as it filled the building so that it was impossible to see anything. This was almost the sole defect in the original plans. It entailed stopping the crushing for a week, but the effect is most successful, a large wooden extinguisher coming down almost to a level with the whole length of the trays, has been made with four square ventilators going out of the roof. This draws all the steam off except when the wind blows strongly from one quarter.

38 men (Indians) are employed in the mill, with an additional ten, half of each day, bagging up, under a mill assistant.

*Machinery* works admirably in every department.

*Boiler and Clarifiers* giving special satisfaction, the trays also act splendidly. The *little pump* is remarked upon by all who see it as a great improvement upon most appliances in use in the colony for raising water.

STATEMENT OF RESULTS OF CRUSHING, 3RD JULY TO 31ST  
AUGUST, 1878.

No. of Acres of Cane Cut.	No. of Loads of Cane.	No. of Clarifiers of Juice.	No. of Gallons Juice.	Average Density Juice.	No. of Tons Sugar made.
64½	3,358	488½	190·620	10½	148½
No. of Days Crushing.	Ave. No. of tons per diem.	Ave. No. of Loads Cane per Clarifier.	Ave. No. of Clarifiers to Ton Concrete.	Ave. No. of lbs. Concrete per gall. Juice.	Ave. No. of Clarifiers per diem.
41	3½	6½	31½ <sup>2</sup> / <sub>3</sub>	1½	11½ <sup>1</sup> / <sub>2</sub>

Sugar-making is to be carried on at Bowen Park, Brisbane, during the time of the exhibition. Messrs. Alfred Shaw and Co. are erecting machinery, and the Board of Enquiry are furnishing cane. The work is to be of a test character to some extent. The Board are desirous of trying the sugar-yielding capabilities of various of their canes, and the work can be most appropriately carried on in public at the exhibition.

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EXTRACTS FROM THE "REPORT ON THE PROGRESS  
AND CONDITION OF THE ROYAL GARDENS  
AT KEW,"

*During the year 1877.*

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CINCHONA.—The success of the experiment of cultivating Cinchonas in Jamaica, the commencement of which I briefly chronicled in my Reports for 1865 and 1868, has now come to the test. Mr. Thomson, the Superintendent of the Botanical Gardens, writes to me under date November 8th, 1877 :—" We have now nearly ready "for shipment about 3000 lbs. of Cinchona bark." This is the first crop from the existing plantations, which at the present date are nine years old. *Cinchona succirubra* grows most rapidly; *C. Calisaya* also does well, but *C. officinalis* assumes a shrubby aspect of growth, and will probably have eventually to be superseded by the other kinds. Mr. Thomson states :—" It has been abundantly "proved that several species of Cinchona are eminently fitted for "cultivation in Jamaica. The enterprise has emerged from the "purely experimental state, and can now be carried on as an "established agricultural industry."

SERICULTURE IN THE COLONIES.—In Jamaica the subject has been taken up by Mr. W. B. Espeut, who is anxious to see the attempt made to cultivate *Bombyx Ricinus*, the Castor-oil plant being particularly abundant in the island. He believes that there is an increasing class of persons among the inhabitants to whom such an industry would be well suited. He also informs me—an observation of some interest—that the ordinary silk-worm (*B. Mori*) can be successfully reared on the leaves of an artocarpaceous tree (*Trophis americana*).

EUCALYPTUS.—The merits of the numerous species of this genus are beginning to be understood, and there is no doubt that where the climate is suitable few timber trees can compare with them for rapidity of growth and excellence of wood. Popular misconceptions still however prevail on the subject to some extent. Attempts to

grow in tropical climate the species of temperate ones, such as *Eucalyptus Globulus* can only result in disappointment; nor must implicit belief be placed in the prophylactic virtues of species of *Eucalyptus* against malarious fevers.

Mr. Nicols, writing in "Nature," (Nov. 1, 1877, p. 10,) only confirms what has reached me from other sources:—

"In Queensland . . . . I have personally suffered from malaria in the very heart of a forest extending for many miles in every direction, and composed mainly of *Eucalyptus*, and not by any means remarkable for the extent of swampy ground, and have known many instances of febrile attacks among shepherds and stockmen in the locality. Moreover, I was told on inquiry that these attacks were not confined to any particular year, but that every year some attacks might be expected."

Mr. Thomson reports from Jamaica:—"The first batch of "*Eucalyptus Globulus* seeds was imported in 1869; the seedlings "were planted out at the Cinchona plantations seven years ago. "Some of these now measure upwards of sixty feet in height, with "the trunks three feet in girth five feet above the ground. Thus "in ten or twelve years large timber trees are producible. No more "valuable tree could be planted on our barren hills that are easily "accessible to the plains."

Governor Robinson writes to me from the Bahamas, October 22nd, 1877,—"I have tried *Eucalyptus* here without success."

In my last report I stated that a species of *Eucalyptus* which had succeeded well at Lucknow appeared from specimens which had been sent to Kew for identification to be *E. resinifera*, Sm. As the determination was not without doubt on account of the incompleteness of the materials for identification, Dr. Brandis caused a further series of specimens to be sent to us. He remarks—"As this is one "of the few species of *Eucalyptus* that seems to thrive in the plains "of North India, and as it is a rapid grower, it is of considerable "interest to name it correctly. Systematic trials of some Queens- "land species are being made at Saharunpore, Lucknow, and in the "Punjab." The specimens sent left no doubt that the tree to which



they belonged was not *E. resinifera* but the nearly allied *E. saligna*, Sm., a native of New South Wales.

PAPER MATERIALS.—I have the following remarks to add to what was stated in the Report for last year.

1. *Bamboo*.—The interest in this gigantic grass as a source of paper material continues unabated both in England and America. Seeing that its cultivation is possible in any tropical country, the supply would theoretically be unlimited. And its excellence as a paper material is of the highest order, “India proof-paper” being said to be made from it.

For the purpose of paper-making the bamboo-shoots must be quite young and succulent. The opinion, however, of tropical horticulturists is tolerably uniform that bamboo-clumps will not stand the continuous removal of their young shoots, but are progressively weakened and ultimately killed by such a method of treatment. And the more limited experience of cultivation under glass in Europe is entirely confirmatory of this belief. Practically, therefore, as stated in my last Report, the cultivation of bamboo for paper-material would have to be pursued in the same manner as sugar-cane, and the ground replanted, if not after the removal of the first crop, at any rate, at no distant date. I am bound, however, to state that persons of undoubtedly competent knowledge of the habits of the bamboo believe that it may be cut continuously in a profitable manner, and the question will probably not therefore be settled till it has been put to the test of commercial success, and money has been either made or lost in the attempt to utilise it.

The economic aspects of the question have been discussed by Dr. King, Superintendent of the Royal Botanical Garden, Calcutta, in his Report for the year 1876-77. I quote the following remarks as deserving the consideration of those interested in the subject.

“Mr. Routledge”—whose efforts in the introduction of new paper materials appear to me deserving of the highest commendation—“suggested that bamboo clumps might, by proper treatment, be “induced, after most of their old shoots had been cut away, to send “up from the stools thus bared, regularly and irrespective of season,

“crops of succulent shoots suitable for conversion into paper-stock. “Mr. Routledge’s expectations implied a very complete change of “habit in the bamboo: for it is pretty well known that bamboo “clumps, if entirely cut down, yield for several years but few and “small succulent shoots, and, in fact, not unfrequently die.” Dr. King has, however, subjected the matter to experiment, but no conclusive result can be expected till the close of the present year.

As representing the opposite view, I will quote the opinion of Mr. Robert Thomson, Superintendent of the Jamaica Botanic Gardens:—

“Cutting the Bamboo stems *en masse* would undoubtedly destroy the plants, but I would remark that the destruction of the plants can be effectually prevented by the adoption of a different process of cropping. Thus, instead of cutting all the stems simultaneously, a given proportion of matured stems should be retained, and this need only be a small proportion, sufficient to maintain the vigorous action of the roots. The stems thus retained for the preservation of the functions of the roots may even be moderate in size. Indeed they may be topped so as to superinduce the sprouting of branches and foliage near the ground. Another point to be observed consists in the manner in which the young succulent stems are cut, that is, the crop for making paper, not close to the ground, but a few nodes above the ground should be left; this plan ensures the sprouting of branches and foliage from some of the nodes thus left, and maintains the unimpaired action of the roots.”

SUGAR CANE DISEASE.—The disease which I mentioned in my last Report as having inflicted great injury on the sugar-cane in Queensland (where it is known as “rust”) has engaged a good deal of our attention. The examination of the numerous documents, both printed and written, which have come into my hands, as well as of the specimens of diseased cane—unfortunately far from satisfactory—which have been transmitted to us from the colony, have led to the following conclusions, which have already been communicated to the Queensland Government:—

1. It appears not improbable that the disease is identical with one which has been noticed in the Malayan Archipelago and in

Mauritius, [Journal Royal Horticultural Society, New Series, Vol. II., pp. cxxxi-cxxxii,] in the Society Islands, according to Professor Liversedge, and in Bahia [Journal Royal Horticultural Society, New Series, Vol. III., pp. 14-17].

2. It is recognised by the appearance on the leaves of red spots known as "rust," which increase in number till the whole leaf withers and ultimately dies. When the leaf is stripped off there is usually found inside the sheath and upon the stem a patch of dark brown or reddish granular incrustation.

3. Professor Liversedge, of the University of Sydney, has studied the disease, and attributes it to defective conditions of cultivation. He considers that the marks on the leaves and the red incrustation on the stem are caused by a fungus of the family *Æcidiaceæ*, but that its attacks are the effect and not the cause of the disease. Professor Liversedge also noted the presence of acari, which he believed fed on the fungi.

3. Dr. Bancroft, in a paper presented to the Queensland Parliament in 1876, distinguished between the disease as affecting the leaf and the stem. He found that the red spots on the leaves eventually produced a fungus with black spores, and he attributed the spots to its attacks. The red incrustation on the stem he also believed to be fungoid, but was unable to throw any further light upon its cause; he detected mites (acari) at the injured spots.

4. In a subsequent paper, Dr. Bancroft [*Sugar Cane*, September, 1877, pp. 476-480] has shown, I think, almost conclusively that the red incrustation is the result of the attacks of an acarus which infests the young shoots of the diseased sugar cane in immense numbers.

5. The specimens sent to this country had been carefully examined before Dr. Bancroft's paper appeared here in print. The Rev. M. J. Berkeley and Mr. Broome, two well-known cryptogamists, satisfied themselves that the red incrustation was in no way due to a fungus, and were disposed to attribute it to the attacks of a coccus.

6. Specimens were then submitted to Mr. McLachlan, F.R.S., by

whom they were sent to M. Signoret, the best living authority on the *Coccidæ*. He arrived at the opinion that the red incrustation was not the work of a *Coccus*, a view in which Mr. MacLachlan concurred. On a further examination of some of the specimens, Mr. McLachlan stated in a letter (September 14th, 1877), that he had found "myriads of what may be collapsed acari."

7. This was independent of, and so far confirmatory of, the observations made by Dr. Bancroft. I think, therefore, that it is probable that the true cause of the so-called "rust" has now been detected. The sugar cane being grown from joints, the acarus would easily be communicated from one crop to another. Dr. Bancroft finds that steeping the joints in milk of lime destroys the acarus, and probably a mixture of two to four ounces of fluid carbolic acid to a gallon of water would be still more effective.

8. The black spored fungus eventually produced by the red spots on the leaves is regarded by Mr. Berkeley as a new species, to which he has given the name of *Depazea sacchari*; he does not consider that it plays any part in the disease, but simply takes possession of the already moribund tissues.

9. Dr. Bancroft has also announced the occurrence of another insect pest of the sugar cane in Queensland:—"From the Albert River I have received specimens of cane with an insect of the 'coccus' genus hiding between the sheaths. It is as large as a Sorghum seed, flesh-coloured, covered with waxy powder. . . They were found on some canes grown from joints newly imported from Singapore. The insect appears to be the '*pou blanc*' of the Mauritius."

Mr. McLachlan obligingly informs me that the *pou blanc*, or rather *pou à poche blanche*, which ravages the cane fields of Bourbon and Mauritius, is a collective name, including two species named by Signoret *Pulvinaria gasteralpha* and *Icerya sacchari*. The Queensland species may be identical with one of these, or possibly a third and distinct species. Mons. E. Icery, who studied the insect in Mauritius, remarks on the extreme tenacity of life in these insects, but states that he found washing the canes with alcohol to kill the

insects at once, and further recommends a solution formed by boiling a mixture of sulphur and lime in water.

10. Mr. Bernays writes to me on what appears to be still another pest of the Queensland sugar cane (November 6, 1877):—

“We are a good deal exercised just now by the appearance of a louse among the roots of some sugar-canes imported from Java. It may turn out to be a form of the well-known ‘*pou blanc*,’ if so, it is at least new to find it among the roots, where its operation appears to be to stop the growth of the cane.”

Diseased sugar cane sent from Natal proved to be effected with sugar-cane “smut” (*Ustilago sacchari*), an analogous disease to the smut of wheat and maize.

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We here append a letter on this subject, by Mr. John Macdonald, which appeared in the *Queenslander*, of July 20th, 1878:—

“I have followed out carefully Dr. Bancroft’s treatment recommended for diseased (or the “rust” in) sugar-cane plants. As to this disease being rust, you know that I was never of that opinion; in fact, you will find, in one of the *Queenslanders* for November, 1875, a letter where I then pointed out that the disease that attacked the sugar-cane was the work of a fungus. Since that time Dr. Bancroft has found out that the disease is caused by an insect of very minute proportions, and not seen without the aid of a very powerful glass. From the reports lately received—which appeared in the *Queenslander*—and from the investigations of Dr. Hooker and others, it would seem that we have not been much enlightened on this very important subject. Whether Dr. Bancroft is right or not I will not undertake to say: but, so far as the doctor’s ideas about the treatment to prevent the disease are concerned, the remedy has been successful.

“Out of twenty-four different varieties of diseased cane treated—the plants were taken from diseased cane, and treated in accordance with the doctor’s written instructions to me—I am glad to say all the plants except two so treated have come up sound and healthy, and the two only very lightly touched with the disease—a few spots only showing on the outer ends of the leaves, while the heart of the

cane is quite green and healthy. All the other twenty-two varieties are clean.

"The old stools or roots from which the plants so treated were taken have all come up diseased; some of them died out; so that there can be no doubt that the doctor's mixture had its effect.

The following are the doctor's directions:—

"1st. Clean the joints entirely from all trash as carefully as possible. 2nd. Immerse for twenty-four hours in water and carbolic acid, at a temperature to bear the hand—1lb. of acid to 50 gallons of water. 3rd. Make milk of lime, at the rate of 2lb. of lime to 1 gallon of water. Immerse the plants in this for a few minutes. 4th. Then lift out and spread in the sun, turning them over to dry for one day before planting.

"I may point out that the plants treated as above came up without a miss, while cane planted at the same time did not come up at all, on account of the very dry season. The amount of moisture absorbed by the plants in the immersing for twenty-four hours, and then in the lime water, I have no doubt had something to do with the plants coming up so regularly.

"I would also point out that this treatment of plants will also kill any of the grubs or seed of the 'borer' and other insidious pests that do damage to the sugar cane. But some may think that Queensland is free from the cane-borer of other sugar-growing countries. Whoever thinks that we are free from this pest is very much mistaken. Hubner has described more than 400 species proper to Europe, where they ravage different kinds of vegetables, either cultivated or wild. A variety of insect from some of the borers is the insect or moth that has been destroying our orange gardens very lately. I have been watching these orange pests for some time past, and have found them on the orange trees after sundown or in the dusk, when they come out of their hiding places. The *lepidopterous* insect which comes from the boring caterpillar belongs to the great family of nocturnal butterflies or moths. If we consider the character of the butterfly of the caterpillar, and particularly if we take due notice of how the latter lives and feeds under cover in the interior of the sugar cane, where it undergoes its metamorphosis, we shall see that our *lepidopter* belongs to the sixth section of the nocturns, as

tortrices of Latreille, Nocturn tortrices of Linnæus, and forming the genus *proceras* of Hubner, in the tribe of pyralites of Lamark, having for its type *Pyrallis soldanana* of Fabricius, which is distinguished from the genus *Pyrallis* by the inferior palpi, which are twice and a half longer than the head, projecting in shape of a straight beak. Our moth or butterfly corresponds perfectly with the above, in the tribe of Pyralites and in the genus *Proceras*, or true "cane borer" (*Proceras sacchariphgus*). The caterpillars have sixteen feet; they live in the interior and tops of the sugar cane. When the young cane or ratoon comes up, you will find numerous small caterpillars appear—that is if all the trash from the old cane was not burned. The caterpillars grow very rapidly, but they are not to be seen in the day-time unless carefully looked for. They twist a fine silk thread round the tender leaf, and there they remain inside all day; but you go in the morning and see what a havoc they have made amongst the tender plants!

"I have frequently left the trash on the ground to retain the moisture, but found that in every case where the trash had been so left the caterpillar ate every green blade of the young cane. Where the trash had been burned on the field, as soon as dry, no caterpillar came.

"The butterflies or moths from the borer caterpillars are of a dirty red or brown. The trunk or tongue, is membranous, rolled up in spiral. I have watched this moth for the last few years, and he takes a great deal of looking after, as he does not show out in daylight, but you can find him at night in the fruit trees and in the sugar-cane, and even on the grape vines when the fruit is nearly ripe.

"I have no doubt that Dr. Bancroft's mixture will kill the larva or seed of the above moth that might still be on cane plants; and I think it would be well to adopt the doctor's plan with all new cane brought into Queensland, before planting. I am of the opinion that, with care, the disease called rust will in time disappear as the different canes become acclimatised in the colony. We have no disease at St. Helena this year (only in the small piece of ground where all the different varieties are kept isolated from the other cane)."

## CONTINENTAL NOTES.

Up to the end of last week the weather continued good; since, rain has set in, and the temperature has sensibly risen. As was expected the beetroot has improved a little, although there are many localities where this improvement has been very slight, if any. Notwithstanding this improvement, it is now feared the beetroots of this year will hardly yield as well as those of 1877. The yield per hectare will be considerably higher, however; in certain localities it will be better by 15 per cent., but on the whole 10 per cent. will likely be nearer the mark. Advices from Austria and Germany announce a considerable improvement in the roots owing to the very favourable weather. They are equal to those of last year, and the juice works easily and well.

Official statistics of the amount of roots worked, and of the importation and exportation from Germany, for the past month (September) in tons.

	1878-79.	1877-78.
Beetroots worked .. .. .	412,649	379,584

## IMPORTATION.

Refined .. .. .	361	712
Raw .. .. .	367	916
Syrup and Molasses .. .. .	492	440

## EXPORTATION.

Refined .. .. .	2,289	1,390
Raw .. .. .	3,126	3,576
Syrups and Mollasses .. .. .	2,714	2,062

Factories at work, 1878, 260.

Official statistical bulletin concerning Austro-Hungary, according to the *Markbericht* in tons:—

## EXPORTATION.

Seasons.	Refined.	Raw.	Total as raw.
1877-78 .....	37,905 .....	98,861 .....	168,347
1876-77 .....	38,480 .....	68,865 .....	115,011
1875-76 .....	40,255 .....	61,381 .....	109,687
1874-75 .....	30,321 .....	26,398 .....	62,787
1873-74 .....	27,902 .....	48,664 .....	82,146
1872-73 .....	23,343 .....	45,526 .....	73,537
1871-72 .....	24,359 .....	39,684 .....	65,315



Dr. Scheibler, who, it will be remembered, recently resigned the editorship of the monthly journal published by the association of the German *fabricants*, has just founded a weekly publication called the *Neue Zeitschrift für Rüben-Zucker-Industrie*. This new journal will be edited in the same manner as the journal of the association, and will contain everything in connection with the sugar industry,—taxes, statistics, agriculture, pure and applied chemistry, special articles, extracts from foreign journals, mechanics, &c. Besides, the notices relative to the manufacture of sugar will be regularly registered in the new journal. The want of a weekly journal has lately been much felt; indeed, Dr. Scheibler suggested to the directorial committee of the association that they should issue their publication weekly instead of monthly, but the proposition was rejected, and hence the founding of the present journal. The first issue of Dr. Scheibler's journal contains the following articles:—On the causes of the exhaustion of the soil by the culture of the beetroot; on the azotised tissues of the beetroot and potato; a description, with drawings, of a new char kiln, by T. Schreiber; notices of warrants of invention, and tables of the quantities of beetroots taxed; of the importation and exportation of sugars in Germany up to the 1st July last.

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The following note, on the constitution of the inactive glucose of raw cane sugar and molasses, was presented to the *Académie* by M. U. Gayon:—It is generally admitted that the glucose contained in the raw cane sugars and molasses is inactive in polarised light. It remains to be established whether this sugar is a special product or a mixture in convenable proportions of left and right handed glucose. Dubrunfaut has expressed this opinion for a very long time, but has never verified it; the experiments made by me appear to confirm it. It is known that beer yeast inverts sugar before causing it to ferment; in consequence, a mixture of cane sugar and inactive glucose cannot be studied optically by the aid of ordinary fermentation. But I have shown that the pure "*mucor circinelloides*," which does not secrete invertive ferment, leaving intact the saccharose, causes, however, the sugars having the composition

of glucose to undergo fermentation. If, then, cellules of this *mucor* are sown in a nutritive solution of cane sugar and a mixture of glucose and levulose, in such a proportion that the rotation of the polariscope will be due only to the cane sugar, it will be seen that the rotation will be progressively diminished to a certain stage; then it will be augmented and will nearly show its original value. In fact, in the fermentation of inverted sugar, the glucose (proper) is first destroyed, the levulose being attached last. This being kept in view, let us submit to the action of the *mucor* solutions of raw sugar or molasses, rich in inactive glucose. If the rotation remains constant, during the fermentation, the glucose will itself remain inactive, and should be considered as a special product; if, on the contrary, the rotation diminishes at first, and then augments, it should be considered as a mixture of glucose and levulose. The following are the results of my experiments; the rotation is expressed in divisions of Laurent's saccharimetre:—

#### I.—RAW CANE SUGAR.

1st.	{ Successive Rotations .. ..	83.8	82.2	84.4	85.4
	{ Reduction Sugar per 100 ..	1.6	.84	..	..
2nd.	{ Successive Rotations .. ..	202.0	198.4	197.4	202.4
	{ Reduction Sugar per 100 ..	3.11	2.35	1.10	.35

In order to obtain greater variations the experiments were repeated with a syrup obtained by washing raw sugar—

Successive Rotations..	187.6	163.2	156.4	153.2	150.0	150.8	151.6	156	160
Reduction Sugar per 100..	6.4	5.76	4.78	3.44	2.58	1.70	1.35	.78	.63

#### II.—MOLASSES.

Martinique Cane	{	Successive Rotations . . . .	108.0	98.0	95.0	118.0			
		Reduction Sugar per 100..	4.58	3.44	1.20	.98			
Nantes Cane	{	Successive Rotations	37	32	28	24	23.6	33	36.8
		Reduction Sugar per 100	8.72	7.83	6.08	4.02	3.58	2	1.15
Bordeaux Cane	{	Successive Rotations ..	42.4	34	40	42.8	44		
		Reduction Sugar per 100	5.63	3.13	1.36	1.15	.88		
Havre Beetroot	{	Successive Rotation ..	80	74	70	68.8	76	78	
		Reduction Sugar per 100	6.16	4.90	3.26	2.30	2.08	1.70	

Thus in all the preceding examples, while the reduction sugar disappeared in a continuous manner, the rotation diminished at first progressively, then it began to grow, and at last nearly reached its original value. Besides, the reduction sugar disappears faster

in the first part of the phenomenon than in the second. The inactive glucose of the raw cane sugars and molasses is then resolvable into a mixture of right and left-handed sugars.

M. A. Leclere, chemist at Mettray, in reply to a question put by the *Bulletin des Agriculteurs de France*, with regard to the nutritive value of beetroots which have seeded, has analysed the root both before and after, with the following result:—

Composition.	Before.	After.
Water .. .. .	84.20 ..	91.300
Ash.. .. .	1.31 ..	1.827
Nitrogenous Matters ..	.92 ..	.812
Cellulose .. .. .	1.16 ..	.757
Sugar .. .. .	5.51 ..	.540
Fat .. .. .	.19 ..	.638
Non-Azotised Extractive Matters .. .. .	6.71 ..	4.726
	<hr/> 100.00 ..	<hr/> 100.00
	<hr/>	<hr/>
Relative nutrition, 1 : 13.8	..	1 : 6.60

According to the analyses, the sugar and fat have much diminished; the cellulose, the nitrogenous matters, and the non-azotised nitrogenous matters have partially disappeared; the water and ash have increased. But the root is still fit for food, and although the quantity of water is very large, it can be easily made up by the addition of some chopped fodder.

For a very long time beetroot cultivators in certain districts have been in the habit of stripping the leaves from their roots during the month of August, and continuing to do so up to the time of pulling them. With the leaves they fed their cattle. As far back as 1831 Mathieu de Dombasle condemned this method. The Institute of Forestry and Agriculture of Hohenheim established, later on, that the leaves constituted very poor nourishment, which at the same time was very laxative, especially for horned beasts, and that cows fed on them gave very watery milk, poor in butter and cream. It also made known that the disleafing always diminished the weight of

the yield. M.M. Violette and Corenwinder recommenced those experiments in the department of Lille, and their conclusions are identical. M. Corenwinder has operated on a square of an *arc*. Bringing his results to the produce of a hectare, he obtained, the 2nd August, 15,000 kilos. of leaves; the 7th September, 7,200 kilos.; the 1st October, 2,000 kilos; and lastly, being the fourth disleaving, made the 15th October, 1,500 kilos, making a total of 25,700 kilos of leaves. In the experiments at Hohenheim, the results obtained varied between 21,000 and 31,000 kilos. As far as weights and the comparative richness of the beetroots are concerned M. Corenwinder has obtained, for the hectare not disleaved, 86,300 beetroots, weighing net (earth and rootlets deducted), 86,500 kilos.; whilst that for the hectare of beetroots disleaved, he obtained 85,900 roots, having a net weight of 71,900 kilos., showing a diminution of 14,600 kilos.; and by making the calculation to an equal number of feet to each experiment, has had a loss in weight of 17 per cent. But it must be observed that the trimming, done in the same way as in the *fabrique*, has produced a very heavy tare on the roots disleaved on account of the considerable development of their rootlets, which would represent about 10 per cent. of the total weight, whilst the rootlets of beetroots not disleaved would not represent above 6·4 per cent. M. Corenwinder has weighed the leaves which remain on the beetroot at the pulling, which took place on the 4th of November. This has furnished 6,600 kilos. of leaves for the untouched, against 3,340 for the others. This small yield in leaves for the roots untouched arises (the maturity being complete) from the large leaves being already withered and almost completely dry. The disleaved roots undergo considerable modifications in their exterior forms—the greater part have the necks lengthened. M. Corenwinder has found beetroots the necks of which had attained to a length of ·07m., and he has comparatively analysed them against roots of the same weight but having the proper form, with the following results:—

Elements.	Intact roots.	Disleaved roots.
Mean weight .. ..	·920 kilos.	·925 kilos.
Density .. ..	4·9°	3·95°

A hundred kilos. contained :

Sugar .. .. .	9·320	6·210
Azotised matters, cellulose, &c....	4·361	4·559
Mineral matters .. .. .	·719	·985
Water.. .. .	85·600	88·250
	<u>100·000</u>	<u>100·000</u>

From the analyses it is seen that the quantity of sugar which has disappeared is 34 per cent. of the total sugar, and that it has been replaced, in great part, by an equivalent quantity of water. M. Violette gives the following as his experiences :—

	Beetroots.	
	Intact.	Disleaved.
Field per hectare .. ..	44,950 kilos.	22,245 kilos.
The weight of the roots has varied from.. ..	80 to 960 grs.	120 to 480 grs.
The sugar has varied from ..	10·26 to 15·88 grs.	8·4 to 12·68 grs.
Mean amount of sugar ..	13·11 grs.	10·54 grs.
Density of the juice at 15° C. ..	1·060	1·04°
Sugar, per litre of juice ..	132·20 grs.	102 grs.
Organic matters other than sugar	10·80 grs.	12·60 grs.
Ash, per litre of juice.. ..	6·20 grs.	6·64 grs.

The difference in sugar is 19·6 per cent. of the total sugar, and the production in weight is reduced a half by the disleaving. Walkhoff says, in his "*Traité de Fabrication du Sucre*," that the beetroots cultivated normally contain 13·72 per cent. of sugar, whilst those disleaved twice only contained 8·34 per cent., a diminution of nearly 40 per cent.; in both cases the weight of roots were equal. It may be concluded from the experiments of MM. Violette and Corenwinder that the disleaved roots take up from the soil, in order to form new leaves, a new quantity of saline matters, that they cause greater exhaustion to the soil, and that it is more difficult to extract their sugar.

The last monthly statistics of M. Licht, contains some very interesting documents. The season 1877-78 may on the whole be considered as a very favourable one. The yield in *masse cuite*

has been about as usual, but the yield of sugar has been very high. The number of factories at work was 329 against 326 of the preceding year. The surface sown was, supposing the same cultural yield for the beetroots grown as for the roots bought, 146,415 hectares in 1877-1878, against 140,784, 141,833, 133,784, and 129,470 hectares for the preceding years. The quantity of beetroots worked, expressed in quintaux of 50 kilos., was in—

1877-78.....	82,139,172	in	329 fabs.
1876-77.....	71,053,745	„	326 „
1875-76.....	83,194,970	„	335 „
1874-75.....	55,105,660	„	337 „

In working, particular results are remarked for 1877-78. On account of the great purity of the juice, the yield of *masse cuite* was, during the beginning of the season, higher than in the two periods corresponding; the mean, for the three months, September, November, was 12·8 per cent. of the weight of the roots, against 11·6 and 12·6 per cent. in 1876-77—1875-76. The yield in *masse cuite* over the whole season was 12·6 per cent., against 11·4 per cent., and 12·8 per cent. in 1876-77 and 1875-76, and the work was well and rapidly done in the 4½ months of September to the end of January, which, in a great measure, may be attributed to the number of factories working the diffusion process. But the most remarkable result of last season was the unusual yield of sugar from the *masse cuite*. The yield of raw sugar of fair quality, was 9·34 per cent. of the weight of the roots, which is slightly better than the seasons of 1874-75, when a yield of 9·30 per cent. was obtained. But besides the extreme purity of last season's juice, there can be no doubt that a part of this yield must be attributable to the processes of extracting sugar from the molasses. The results recently published for France, show that the yields are much below those got in Germany. The following is a comparison:—

	1877-78.	1876-77.	1875-76.	1874-75.	Mean.
Germany....	9·34	8·20	8·33	9·30	8·54 per cent.
France.....	7·20	5·00	5·20	5·66	5·76 „
					<hr/> 2·78 <hr/>

This difference is due to the quality of the root, which, in Germany, is cultivated with a view to the greatest production of sugar and to the German method of working being based on the extraction, as complete as possible, of the sugar contained in the root. The exportation of German sugars was 98,924 tons in 1877-78, against 60,588 tons in 1876-77, and 49,846 tons in 1875-76. The exportation of sugars is greatly encouraged by the method of taxation, by means of which sugars exported obtained above 8·51 per cent. of the beetroot enjoy a bounty more or less considerable.

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We learn with pleasure that M. Maumené has been named Professor of Chemistry of the Faculty of Sciences of the Catholic Academy of Lyons. The new duties of M. Maumené will not prevent him in the continuation of his researches on the properties of sugar.

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The *Antigua Observer* says:—A leading feature of the season was the very large number of Porto Rico cargoes which had gone into the United Kingdom, instead of going as in years past to the United States. This has gone a long way towards supplying the deficiency from Cuba. The growing Beet crop was still reported to be in a favourable condition, but that circumstance had made, it is said, little or no impression on the market, although it had made people cautious in entering into distant transactions. Antigua concrete had sold for nearly as much as Antigua muscovado, showing that a considerable improvement has taken place in the manufacture of the former article. Good to fine Antigua concrete had fetched in Liverpool 19s. 6d. to 20s. 6d., against 20s. 9d. to 21s. 9d. for good brown Antigua sugar, so that considering the concrete process gives out no molasses, nor any but the slightest minimum of wastage, it must pay much better to make good concrete.

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WATER AS A MOTIVE POWER.

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Messrs. W. H. Bailey and Co., of the Albion Works, Salford, have recently introduced a very useful invention designed for the purpose of utilising water as a motive power in a different manner and to a greater extent than it has hitherto been employed. The machinery now driven by water consists chiefly of the waterwheel and the turbine, but these are only useful where water exists in great abundance, as in a stream or river, and are therefore not adapted to large towns, where the supply is not so great. Messrs. Bailey's motor works under the ordinary pressure of the water sent through the street mains, and may therefore be easily applied wherever such a supply exists. In appearance it is somewhat similar to an ordinary horizontal steam engine. It has an oscillating cylinder, with parts so arranged that the motion of the cylinder cuts off the supply of water at the end of the stroke, a reciprocating action being thereby obtained and imparted to the flywheel by the ordinary crank arrangement. There are no loose valves or tappets in connection with the motor, and all the fixing it requires may be done by a plumber, as there is nothing more to do than to connect the machine with a pipe from the street main. One of the motors is working very successfully at the bottom of a colliery shaft near Bolton, the power being supplied by the water pumped up from the pit by the steam engine. A large number of laden waggons are drawn up an incline with great ease by this means. The motion has also been utilized for sawing timber, printing newspapers, pumping water from low to high levels, and for many other purposes. The saving effected is not only in the difference between the price of the water which is used and that of the coal which would be consumed if the power were supplied by steam, but also in the labour required, as machine wants no more attention than the mere turning of a tap when it is to be set in motion. The sanitary advantages arising from the use of water instead of coal are also very great, and would alone in many cases suffice to recommend the water motor in preference to the steam engine.



## STRENGTH OF AXLES.

By ALFRED FRYER.

As much uncertainty prevails as to the strength of axles required for definite loads, the actual results from axles of various sizes have been obtained and a rule deduced. Much, however, will depend upon the character of the roads traversed, and the quality of the materials used in construction, as well as upon other considerations, but the rule here given may be depended upon for axles of good quality under all reasonable conditions.

One pair of wheels and axle will carry, including their own weight:—

Diameter of Axle.	QUICK SPEEDS. Carriages, Omnibuses, &c.		SLOW SPEEDS. Coals, Blocks of Stone, Steam Boilers, &c.	
	Ordinary Load.	Maximum Safe Load.	Ordinary Load.	Maximum Safe Load.
Inches.	Cwts.	Cwts.	Cwts.	Cwts.
1½	18	21·6	29·25	36
1¾	24·5	29·4	39·81	49
2	32	38·4	52	64
2¼	40·5	48·6	65·81	81
2½	50	60	81·25	100
2¾	60·5	72·6	98·31	121
3	72	86·4	117	144
3¼	84·5	101·4	137·31	169
3½	98	117·6	159·25	196

RULE.—Each square inch of sectional area of axle will sustain, including the weight of wheel and axle:—

Quick speed, ordinary load ..... 4·0 cwts.  
 „ maximum safe load ..... 4·8 „  
 Slow speed, ordinary load ..... 6·5 „  
 „ maximum safe load ..... 8·0 „

*Examples.*—What will a dray carry (gross weight, including itself) as maximum safe load of stone, front and back axles being  $2\frac{1}{2}$  inches in diameter? Answer: 200 cwts. What nett weight is the ordinary load for an omnibus, the front axles of which are  $2\frac{1}{2}$  inches and the back axles  $2\frac{1}{4}$  inches in diameter, the weight of the vehicle being 22 cwts.? Answer: 68.5 cwts.

NOTE.—The maximum safe load for slow speeds is just double that of ordinary load for quick speeds.

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## Correspondence.

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### SUGARS FROM SORGHUM, AMBER CANE, &c.

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TO THE EDITOR OF "THE SUGAR CANE."

Sir,

I am quite sure that it will be interesting to your readers to know that the sugar interest in America is now seriously affected by operations in a new quarter.

In the United States a great quantity of sorghum is grown; the ordinary sorghum, as is well known, will not give a crystallizable sugar, but the Americans have discovered a method of obtaining a dry deposit or result from it which is now produced in considerable quantities; they have also done the same with glucose made from corn. Both these substances can be refined as to colour in a great degree, and both these sweets are now made use of to "lower" the quality of cane and beet sugar, and this is done to such an extent that ordinary moist household sugars are now sold retail in Toronto at a very shade higher than the wholesale price of the best cane and beet sugars, when sold by thousands of tons.

Of course, sugar so debased would not do for refining, as the glucose or grape sugar would all be separated, but the practice with moist household sugars is continued and carried to a great extent; the adulteration is not recognizable by the ordinary observer, and the lowered article is sold by the retail grocers at so many pounds for a dollar like the very best class of cane sugar. It is white and good and wholesome, but comparatively very weak. The users do not,

however, recognize this fact, and are content with the apparent cheapness.

When fine high grade sugars are cheap these low grade, soft, manufactured, and adulterated American sugars cannot readily be sold, except during the season in which green fruits are used in large quantities. When the fine sugars are high in price there is a much better demand for the low grades.

The price for low grades, laid down and duty paid to wholesale purchasers for cash, often ranges at 6 cents per lb., about 24s. sterling per 100 lbs. on credit sales. Add to this exchange, freight, and 30 to 60 days' interest, as is the custom of the trade, and then these sugars cost about  $6\frac{1}{2}$  cents per lb.

They polarize very low. Some wholesale men refuse to keep them, as their low price, and grade, disturb the price of the best article.

Almost all these low grade sugars come from the United States; very little if any is sent from Britain to Western Canadian cities.

There is another element which bids fair to grow into favour, and will exert a considerable influence on the sugar trade.

In the researches into sorghums, which were exclusively grown for syrup only, a variety has been discovered which will produce a crystallizable sugar. This is called "the amber cane," and the seeds of it have been extensively circulated by the agricultural department of the American Patent Office. Parties who know all about it tell me that it will grow wherever Indian corn will come to perfection. I should not like to guarantee this, as I have never yet seen the plant; but I have seen the samples of sugar which are circulated by the American Patent Office, and which are stated to be obtained from the evaporated juice direct, without defecation with lime or other chemical. A prettier sugar I never saw, but it seems weak. If the plant will come to perfection for sugar wherever Indian corn will grow, it opens the whole of the Northern States and a large part of Canada to the crop, and the results cannot but be important; for even if the plant should not always perfect its seed, we can always import that from the south. The refuse is just what we want for cattle, and if diffusion is used there is no doubt that this kind of sorghum (even if imperfectly

ripened) will produce largely of sugar, and the refuse will be so valuable for cattle food as to make up for other deficiencies.

The following extracts, cut from well-posted and influential papers, will show what progress "the amber cane" is making.

E. L. C.

*Toronto, 21st September, 1878.*

Washington, September 18th.

The Consul at Hamilton reports that an American from Ohio, has raised, eighteen miles from Hamilton, five acres of amber-cane, equal to the best sugar-cane grown in the Southern States. The cultivation of sugar-cane will, probably, soon become an extensive industry in the peninsula between lakes Erie and Ontario.

As the manufacture of sugar from this new variety of sorghum is attracting much attention, the following notes on the manner of harvesting this cane, from a Minnesota farmer, will be interesting:—  
"I have always had the best results with ripe cane, that is, when all of the seeds are well formed, and ripened. The first thing to be done, when your cane is ready to cut, is to procure good corn knives, (old scythes won't cut cane well), and let two men cut together, taking two rows each, cutting the four rows side by side, and laying the cane on the ground in a windrow in the space between the two inside rows which are being cut, commencing at the first hills at the edge of the field. The first hill cut and laid down with the butts toward the standing cane, cut the second hill, and lay it down directly upon the other with the butts about one foot ahead the next hill; cut and lay upon this in the same manner, and so proceed until you have gone through the field, always lapping the last hill you cut and lay down nearly one foot over the last one laid down, always being careful to lay the canes straight, not crossing the windrow, but always letting the heads fall directly on the top of the windrow. This once well done, it will be in a condition which will season out in a most admirable way, and is well protected from frosts. Should any frost overtake your cane and kill the leaves, before it is cut, by all means don't let it stand a day longer, but withdraw it at once. No matter if your cane is or is not ripe. The

frost ripens it at once, and it must be cut. Should a severe freeze come suddenly upon standing cane, which freezes the stalk through, then there is great cause for alarm, as all of the cellular tissues which hold the saccharine juices of the stalk intact then become ruptured, and flow unrestricted within the pith, and as the juice is of a very perishable nature when exposed, it soon becomes sour. There is no danger at all of souring if the pith of the cane has not been frozen, and there is no occasion to worry yourself, or the manufacturer, to work it up, for it is absolutely safe, and makes a better syrup by laying several weeks after cutting,

Cane should not be left in the windrow in the field, in the hot, drying winds and sun too long, as it will gradually dry out the watery portion of its saccharine juices, so much so as to materially injure its value. After ten or fifteen days from the time of cutting, according to the dryness of the weather, the cane should be examined for the purpose of ascertaining whether or not it is drying up. This may be easily determined by lifting an armful of the cane, and to an observing person it will quickly become apparent, as one will at once discover the difference in its weight, as compared with its weight when first cut. As soon as this difference is discovered, the cane should be topped and hauled, and stored in sheds or barns, safe from frost, storms, winds, and sun, securely packed away in a good dry condition to await the time when it can be put through the mill.

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#### GILL'S PROCESS.

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TO THE EDITOR OF "THE SUGAR CANE."

Sir,

Mr. Gill's efforts to clarify cane juice have been long before us. By competent and incompetent persons, in public and in private, its capabilities have been freely discussed. Some were scared by the common blunders of early attempts; and it remained for Mr. Ellis to publish the history of his incomplete efforts, aided by your very judicious arrangement, to furnish us with Mr. Gill's detection and explanation of Mr. Ellis's omission, which omission was the parent

of his complaint. As Mr. Gill very pertinently puts it, whence comes the "large sediment" which Mr. Drumm discovered? Clearly it was simply the coagulated and oxidised impurities of Mr. Gill's successful effort, which Mr. Ellis had omitted to remove when they had been collected for him; this was the little all that remained for Mr. Ellis to do, but which he failed to do. Of one thing we may be certain, those impurities would not have assumed the solid character by the old process. They would have been dissolved by lime, to become the stereotyped molasses, laden with some 60 per cent. of sugar, which planters cannot afford to lose at the present time—rum being but another name for loss. We obtain from those formidable results sufficient practical and tangible evidence of the success of Mr. Gill's new process, which is evidently capable of affording a much larger product, even if it does no more than obviate the customary serious loss of sugar in molasses. I therefore beg to congratulate Mr. Gill on the satisfactory result of this adverse trial. Probably all who understand this intricate subject will do the same. At the same time it would be ungracious not to thank Mr. Ellis for the honesty and boldness manifested in the publication of his own unintentional error. It may serve as a beacon to others.

Yours, &c.,

NOMEN.

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#### ALLEGED SUGAR FRAUDS IN NEW YORK.

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The *New York Tribune* says: That special Treasury Agents have been engaged for some time in investigating alleged frauds in weighing and sampling sugars, both imported and for export. Complaints were received by Collector Merritt and by Secretary Sherman, from merchants of New York, Boston, Philadelphia, and Baltimore, and an investigation was begun about two weeks ago, Special Treasury Agents Chamberlain and Ayres, of Washington, Mr. Ransom, an expert, of New York, and a corps of experienced samplers and examiners being selected for the work. It is claimed that the order issued by Collector Merritt called for such a search-

ing investigation that it placed the department in a position to compare the actual or true samples of cargoes of sugar in the bonded warehouses with previous appraisements, so that there could be no escape from legal responsibility should the alleged fraud be discovered. The position taken by the special agents was that no importer or refiner who had faithfully complied with the law could object to a resampling of his cargoes, whereas those who had resorted to bribery or other improper means to obtain a low classification of sugars would at once be detected.

It is reported that the Government examiners have already discovered frauds of an alarming character. In every instance samples have been preserved, many of which are said to show that by an improper classification, sugars which should have honestly paid a duty of  $2\frac{1}{4}$  cents a pound, have only paid 2 cents, and those which came under a 2 cent duty were passed through the Custom House at  $1\frac{3}{4}$  cents a pound. The evidence, it is claimed, shows that this system of fraud has been going on for several years, and it is estimated that the loss to the United States revenue has been at least 6,000,000 dols. a year. The amount collected in 1877 on sugars imported into the United States was :—On sugars under No. 7, 16,000,000 dols.; under No. 10, 15,000,000 dols.; over No. 10, 3,000,000 dols.; total, 34,000,000 dols. It is claimed by Treasury Agents, importers, refiners, and others, that the Government, should have collected, if honesty had prevailed at least 40,000,000 dollars. It is further stated that the Treasury Agents have met with some obstacles, in the course of their investigation, by the removal of sugars in bond and that in order to secure a test before the sugars were cast into the boiling pots, where identity would have been lost, that they were compelled in several instances to follow the sugars on lighters and into the refinery. In these cases it is charged that the improper classification was most marked. Another branch of investigation is the question of weights, and most of the cargoes of sugar in bond have been reweighed to ascertain what difference, if any, has been allowed in special cases. It is charged that in some of the cases

under investigation a difference of 100 lbs. in each hogshead has been discovered.

The most serious frauds are said to have been discovered in the sugars sampled for export. Custom House officials admit that this is a branch of the sugar business where frauds can be practised most easily, and to prevent refiners from shipping a different grade of sugar from that on which drawbacks were received, Collector Merritt has designated officers to watch the cargoes exported and to test them after they reach the docks for shipment. One of the charges preferred against certain refiners is that they introduced glucose and chemicals in the manufacture of sugars for export, and that in this way the revenue laws are defeated by shipping the same style of sugar on which heavy drawbacks are paid, but of a much inferior quality. To meet this charge by thorough investigation, it is stated that Government chemists for several weeks have been making tests of sugars and syrups exported in order to report what proportions of glucose or grape sugar have been added to the syrup or sugar. As a proof of the great use of glucose, it is shown from the Custom House records that the importation has increased in the value from 2,352 dols. in 1876 to 233,366 dols. in 1877. As it pays no duty, it is claimed that it is a fraud on the Government to demand a drawback for it when manufactured into sugar. The oath taken by exporters declares what particular importation the sugars exported are manufactured from, and the special agents claim that any mixture of foreign substances in such sugars will bring the matter under the criminal law. To make this branch of the investigation complete, it is stated that United States consular agents abroad have been instructed to make an examination of the sugars exported from this country, and to report at once, and that should these reports show that the exportations were not up to the standard on which drawbacks were paid, suits will be instituted by the Government against the guilty exporters to recover the money thus illegally drawn from the United States.

Col. Chamberlain has been instructed to report in writing the result of the investigation, and should it bear out the evidence of



fraud said to have been obtained, Collector Merritt will at once order a reliquidation, and suits will be at once instituted. Col. Chamberlain declines to furnish any information on the subject. He will submit his report in a few days.

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#### 100,000 FRANC PREMIUM.

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It is announced that the Authorities of Guadeloupe have offered a premium of 100,000 francs to the inventor of a process to obtain a yield of fourteen per cent. from the sugar-cane. The competition is open till June 30th, 1880. It is not for an improvement on sugar mills, but for the discovery of a process bearing upon the yield of turbinated sugar. All the expenses of transit, putting up of machinery or implements, are to be borne by the inventor.

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#### THE SUGAR BOUNTIES.—AN APPEAL.

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The Workmen's National Executive Committee at Bristol, engaged in the present movement for the total abolition of the Foreign Sugar Bounties, having expended most of their available means of continuing the agitation, appeal to their friends for pecuniary assistance. The well-known banking firm of Miles, Cave, & Baillie, Old Bank, Bristol, have consented to receive donations or subscriptions in support of this very necessary movement on the part of the sugar operatives who are determined to do all they can during the Parliamentary recess to arouse public attention in the great centres of industry to the flagrant injustice of the bounty system.

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SUGAR CANE CRUSHING MACHINERY.—We observe that Messrs. G. Buchanan & Co., engineers, of Bucklersbury, London, E.C., have just been awarded the gold medal, class 52 (*section Anglaise*), for their steam engines and cane-crushing machines at the Paris Exhibition.

## MONTHLY LIST OF PATENTS.

Communicated by GEORGE DAVIES, C.E., Patent Agent, 4, St. Ann's Square, Manchester.

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## ENGLISH.

## APPLICATIONS.

No Applications relating to sugar this month, and no Specifications of inventions relating to sugar were published this month.

## AMERICAN.

No American specifications received this month. The following left over from last month for want of room.

204,834. PETER B. LAWSON, of Cold Spring, New York. *Improvement in centrifugal machines.* This invention is an improvement upon Lawrence Hardman's English Patent No. 9,898, A.D. 1843, and relates to the bottom valves of centrifugal machines. This valve is placed on the outside of the bottom of the basket, and is fitted on a bearing or flange on the outside of the said bottom by means of a ring fastened beneath the valve to the bearing or flange. The valve is in the form of a flat disc, having segmental openings formed therein corresponding to similar openings formed in the bottom of the basket. A slot is formed in the valve into which enters a stop attached to the bottom of the basket, and when the latter revolves this stop abuts against one end of the slot, which is so formed that at this point the valve is closed and revolves with the basket. A spring stop fixed in the tub or fixed part, when pressed forward catches into notches in the periphery of the valve and thus fastens it rigidly to the stationary part. When the revolution of the basket is stopped this stop is made to catch into one of these notches, and the basket is then turned in the opposite direction until the stop fixed to the bottom of the basket abuts against the other end of the slot in the valve, and at this point the latter is opened.

205,592. ALBERT E. WARE, of Hancock, New Hampshire. *Improvement in sap-buckets.* The bucket or pail is made in the usual manner, except that it has a hole in one side near its top to adapt it to be placed upon and hung from a sap-spout, on which is formed a shoulder or key to prevent the bucket from falling off the sap-spout. The bucket is provided with a cover, which has its corners bent down so as to rest against the sides of the bucket and keep the cover always in its place. Thus sap may be poured from the bucket, by turning the same on the spout, without removing the cover, the down-turned corners of which serve as a spout to guide the sap into the vessel into which it is to be poured. In the hole in the side of the bucket a notch may be made, through which the key or shoulder can pass, and thus the bucket may be removed without detaching the spout from the tree.

206,263. EDWARD K. RICHARDS, of Cambridge, Massachussets. *Improvement in measuring and discharging apparatus for bone-black furnaces.* This invention relates to that portion of a bone-black furnace which measures the bone-black as it falls from the cooling tubes, and consists chiefly of two plates worked by a cam, the one plate cutting off the connection between the cooling tubes and the measuring boxes, whilst the other is discharging the bone-black therefrom, and the latter plate closing the discharging openings; whilst the first reopens the orifices communicating between the cooling tubes and the measuring boxes, and thus refilling the latter. The plates are actuated by the cam, and slide backwards and forwards upon rollers.

206532. RHODON M. BROOKS and JAMES M. BROOKS, of Jenkinsville, Georgia. *Improvement in syrup evaporators and skimmers.* This pan consists of two side bars and a bottom, which latter is provided with low cross-bars to strengthen it, and also to cause agitation of the juice as it passes over them. Near one end is a partition across the pan, provided with a small opening near the bottom, which opening communicates between the two compartments, formed by the said partition, and can be closed at will by means of a gate. On each of the side bars is fixed a trough, extending from the partition along the larger compartment, and sloping downwards, leading to a cooling surface at the other end of the pan. A tight lid is placed over the pan, resting on the troughs, and thus covering almost all the large compartment. Along the upper edges of the troughs are holes, through which, by rapid boiling, the juice is forced, and conveyed down the slope to the cooling surface, where the scum is removed at leisure. The remaining scum, as it rises to the surface, will be conveyed by the steam to the cooling surface, which is the only uncovered part.

Re-issue No. 8341. DANIEL M. COOK, of Mansfield, Ohio. *Improvement in processes and apparatus for evaporating and defecating cane juice.* This invention consists in the combination of an evaporating pan and furnace, constructed as follows:—The bottom of the pan is furnished with ledges, arranged at proper distances apart, extending nearly across the pan and striking out alternately from opposite sides thereof, so as to form a zigzag channel from end to end. Beneath this pan is placed a fire-box, of less width and less length than the pan, and a flue of equal width, but less depth than the fire-box, extends to the other end of the pan, and communicates with a smoke pipe. The central portion of the bottom of the pan thus forms the top of the fire-box and flue, and is heated; the side portions of the bottom of the pan remain cool, and thus the juice as it flows along the zigzag channel is alternately passing over heated and cool surfaces. The whole apparatus is mounted on rockers, to regulate the flow of the juice.

## AUSTRIAN.

(Patents issued during February.)

5. E. BÖGEL, of Brünn. *An expeditious method of refining sugar.*  
9. J. BUDINSKY, of Liban. *A process for boiling sugar juice into raw sugar, and for boiling the secondary products.*  
40. E. MANBRÉ, of Argenteuil (France). *Treating soiled corn and plants for utilizing them for the manufacture of sugar and alcohol.*  
55. H. PRIEW, of Bernberg. *A centrifugal process for treating beet-pulp with super-heated cleare for obtaining white sugar.*

(Patents issued during March.)

3. FR. BACHET and D. SAVILLE, of Paris. *A process of saccharifying feculent substances for obtaining alcohol.*  
12. BOLZANO, TEDESIO, and Co., of Schlan. *Improvements in fastening lids of vessels in general, and especially lids of diffusion vessels in sugar works.*  
37. R. FRÉMAUX, of Paris. *An improved centrifugal and crystallizing process for sugar.*  
76. L. LOTS, of Shärbeck, and A TISON, of Brussels. *A horizontal bag-filter for sugar works and other works.*  
87. E. MÉRIOT, of Paris. *A centrifugal process for obtaining white sugar in blocks.*  
102. F. QUIS, of Untre-Bucie, near Czaslau. *An improved preheater for the diffusion-juice of sugar works.*

(Patents granted during April.)

16. A. G. BUONACORSI DI PISTOJA, of Vienna. *A substitution process for obtaining saccharate of calcium from molasses.*  
30. FREZON & Co., of Paris. *Obtaining pure beet juice in sugar works.*  
78. A PROSKOWETZ, of Sokolnitz. *A provisional cover for lump sugar previous to packing in boxes or paper.*  
86. V. ROHN, of Budweis. *A juice collector for evaporators.*

(Patent granted during May.)

68. E. LANGEN, of Cologne (Prussia). *A centrifugal process of refining sugar.*

(Patents granted during June.)

55. A. ZENISEK and Dr. C. SCHMIDT, of Dobravitz. *A defecating process for separating non-sugar from the by-products of malasses.*  
56. A. ZENISEK and Dr. C. SCHMIDT, of Dobravitz. *Improvements in the defecating process for molasses and the by-products in sugar works.*

## BELGIAN.

45824. A. L. G. DEHNE. *“Wooden filters and applying them to filter-presses.”*  
45827. E. JOORIS. *A machine for cutting sugar.*

45903. L. DEWILDE, of Tirlemont. *A perfectly pure fat substance for superseding grease in boiling beet juice.*
45928. E. TISON and A. LOTS. *Decolouring and drying loaf sugar.*
45934. M. WEINRICH. *Preparing and heating saccharate of calcium.*
45939. E. LAINE, of Tournai. *A method of saccharifying maize and other grain, and fermenting molasses.*
45963. L. CAYEN. *A mill for working the scum of sugar works.*
46024. FIDERLAY, of Brussels. *An automatic apparatus for clarifying condensed liquid.*
46053. L. P. F. DERVAUX. *Boiling cane and beet syrup in sugar works.*
46115. J. BOWING. *Improvements in filter presses.*
46123. H. JEAN, of Cuesmes-Mons. *A scraper for beetroot fields.*
46210. J. SCHWARTZ. *Improvements in the manufacture of sugar.*

## FRENCH.

122321. BOUILLAUT. *A full speed screw scumner for boilers employed for carbonating beet juice.*
122345. RILLIEUX. *A multiple system of evaporating in vacuo, applicable to sugar juice and other liquids.*

## REDUCTION OF THE RUSSIAN DRAWBACK.

As we are going to press,—Mr. Martineau, Secretary of the British Sugar Refiners' Committee, telegraphs to us as follows :  
 “ Just received a letter from the Foreign Office informing me that the Russian Drawback is reduced 15 copecks on refined, and 10 copecks on raw sugar per pud.”

## SUGAR STATISTICS—GREAT BRITAIN.

To OCT. 19TH, 1878 AND 1877. IN THOUSANDS OF TONS, TO  
 THE NEAREST THOUSAND.

	STOCKS.		IMPORTS.		DELIVERIES.	
	1878.	1877.	1878.	1877.	1878.	1877.
London ....	57	79	209	243	247	216
Liverpool ..	25	28	158	165	164	154
Bristol ....	2	2	36	35	36	36
Clyde .....	47	36	208	208	201	190
Total ..	131	145	611	651	648	596
	Decrease.. 14		Decrease.. 40		Increase.. 52	

STOCKS OF SUGAR IN THE CHIEF MARKETS OF THE WORLD ON THE  
1ST SEPTEMBER, FOR THREE YEARS, IN THOUSANDS OF  
TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
179	49	22	9	3	262	259	272

CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING  
1ST SEPTEMBER, IN THOUSANDS OF TONS.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
928	269	26	290	194	1707	1537	1652

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE,  
FOR THE ENSUING SEASON, COMPARED WITH THAT OF THE THREE  
PREVIOUS SEASONS.

(From *Licht's Monthly Circular*.)

	1878-79.	1877-78.	1876-77.	1875-76.
	Tons.	Tons.	Tons.	Tons.
France .....	380,000 ..	398,132 ..	243,295 ..	462,259
Germany (Zollverein) ..	385,000 ..	383,828 ..	291,204 ..	346,646
Austro-Hungary ....	335,000 ..	330,792 ..	247,175 ..	208,912
Russia and Poland ..	215,000 ..	220,000 ..	250,000 ..	245,000
Belgium .....	65,000 ..	63,075 ..	44,467 ..	79,796
Holland and other Countries.....	30,000 ..	25,000 ..	25,000 ..	30,000
Total.....	<u>1,410,000</u>	<u>1,420,827</u>	<u>1,101,141</u>	<u>1,372,613</u>

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STATE AND PROSPECTS OF THE SUGAR MARKET.

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The Sugar Market has been almost stationary during the past month, and prices are very little altered.

The stock of sugar which hitherto we have recorded as less than at the same period last year shows now on the other side. On the 21st September it was 11,000 tons in excess of the same date in 1877; on the 19th October it was 14,000 tons *less* than at the same period in 1877.

The deliveries for the year to date are about 52,000 tons in excess of those to the same date in 1877.

These figures would indicate better prices; but the prospect of the new beet crop is a good one, whilst Paris loaves, the key to English prices, have been sold at a decline of 6d. on the month; and these circumstances have, together with the commercial dissasters of the month, affected the market unfavourably.

The Beet Raw Market closes rather lower.

Present quotations of the standard qualities are as under:—  
Porto-Rico fair to good refining, 21s. to 21s. 6d., against 21s. to 21s. 6d.; good to fine grocery, 22s. 6d. to 24s. 6d., against 23s. to 25s.; Martinique crystals, 25s. to 26s., against 26s. 6d. to 27s. 6d.; No. 12 Havana, 23s. to 23s. 6d., against 23s. to 23s. 6d.; fair to good refining Cuba Muscovados, 21s. 6d. to 22s., against 21s. to 21s. 6d.; middling to good brown Bahia, 18s. 6d. to 19s., against 18s. to 19s.; good to fine Pernambuco, 19s. to 20s., against 19s. to 20s.; Paris loaves, 27s. to 27s. 9d., against 27s. 6d. to 28s. 3d.

# THE SUGAR CANE.


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VOL. X.

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 The writers alone are responsible for their statements.

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## MR. GEORGE ANDERSON, M.P., ON THE SUGAR QUESTION.

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The meeting at Glasgow, under the auspices of the Glasgow United Trades' Council, and the important speech of Dr. Cameron, M.P., were fully reported in the last number of the *Sugar Cane*. Previous to that meeting a correspondence took place between the Trades' Council and Mr. George Anderson, M.P., and was published in the *Glasgow Herald*. Mr. Anderson, following the lead of the *Scotsman* and *Glasgow Herald*, and evidently not caring to deal with the subject on its merits, seized the opportunity of posing as a champion of free trade, and uttered many high sounding platitudes about "protection," "reciprocity," "retaliation," "reactionary policy," and "plausible infringements of free trade." This naturally gave rise to some correspondence in the columns of the *Glasgow Herald*, which we think it well, in furtherance of the policy we have advocated, to reproduce. It turned out, at the meeting, that Dr. Cameron gave a sufficiently crushing rejoinder to this show of zeal for free trade principles on the part of his colleague. "We are told," he said, "that the imposition of a countervailing duty would be subversive of the principles of free trade. It might be subversive of the fetish free trade which many men blindly worship, but it would be in exact accordance with the fundamental principle on which the whole theory of free trade is based." Again, with reference to the hard words "protection" and "reciprocity," he



says: "To conduct our commerce with the maximum of permanent benefit to the Commonwealth, every free trader admits—and I as a free trader most readily admit—there must be no talk of protection or conditional reciprocity. I ask for neither protection nor trade reciprocity, I ask for trade preservation, which is a very different thing. If I demanded protection, I should ask for the imposition of such a duty as would keep foreign sugars out of the market. If I desired reciprocity I should say, let France take off her differential duty against our sugars, or we will impose a differential duty against hers. I ask for neither of these things." Again, in answer to the off hand argument that if France makes us a present we ought to accept it, he says: "I have never heard anyone dispute the abstract desirability of putting an end to the bounty system—a circumstance which strikes me as strange; for it seems to me that if you concede the desirability of putting an end to it you concede everything. If it is desirable to put an end to it—if it is desirable to prevent other nations from spending a million a year for the purpose of cheapening our sugar—it must be because the way in which the cheapening is accomplished is injurious to Great Britain, because the ultimate and indirect loss to the consumer more than counterbalances any immediate gain. If this be once admitted it seems to me that we are justified not merely in advocating the discontinuance of the bounty system, but in actively defending ourselves against it. But is it agreed that the system is a pernicious one? Have we consistently tried to bring the system to an end? Indisputably. During the past fifteen years various statesmen and different parties have been in power in this country, but the policy we have adopted has never once changed." He then describes the negotiations of those fifteen years, and points out how the "recalcitrancy on the part of France," who "on one pretext or another, not only evaded her obligations but increased her bounties and her *surtaxes*," led to innumerable Conferences and endless despatches, during which our policy never wavered. "From first to last our object was to get these bounties abolished. Why then have we so persistently urged their abolition? Because it has been the belief of every minister who controlled

our policy, that these bounties were detrimental to Great Britain. If this be the case, I confess that I can see no reason why we should continue to see ourselves injured without raising a finger in our own defence." "Every change in the course of trade is accompanied by temporary suffering and individual loss. Where these are counterbalanced by a permanent general gain, I should be the last to interfere. But here the gain is fugitive, the loss will be permanent. We ask the Government to preserve us against that loss." In reply to the only argument advanced by Prof. Fawcett, he says: "In the course of the discussions on the sugar bounties many false analogies have been started. We have been asked, for example, whether because the United States interposes a prohibitive tariff against our manufactures, we should retaliate against her. Certainly not: but the question has no more to do with the proposal of a countervailing duty to neutralise the sugar bounties than it has to do with squaring the circle." These it must be recollected, are the opinions and arguments of a strong liberal and free trader. Mr. Stewart, M.P., touched upon the same point. The case of the sugar refiners and colonial producers was, he said, "a totally different case from that which had been mentioned of the Belgian locomotives. If the Belgian locomotives had had bounties placed upon them in order to introduce them to this country, that would have been an analogous case; but there was nothing of the kind. They could not compel foreign nations to adopt free trade; they could not force them to remove prohibitive duties upon our exports; but that was a totally different thing from upsetting the natural course of trade by the provision of bounties." These statements of liberal politicians are in exact accord with what the Chancellor of the Exchequer said last June, when he declared that though "we ought not, by any legislative enactment, to interfere to prevent other countries making use of their natural advantages to supply us with the products which they could supply more cheaply than we could, that principle did not apply to a case in which, by legislative action on the part of a foreign Government, by any artificial action on their part, they could supply

us with an article which, if things were left to their natural courses, we could supply as cheaply or more cheaply ourselves." This, Mr. Anderson says, is reactionary. Fortunately, his colleague has, by the force of his arguments and the clearness of his statement, distinctly shown that it is, on the contrary, "in exact accordance with the fundamental principle on which the whole theory of free trade is based."

Mr. Anderson, though good at high-sounding phrases and clap trap assertions, does not attempt plain argument. He is, as he says, "far too unwavering a free-trader for that," and he is content to "simply brush aside the sophistry" by which Dr. Cameron has proved who is the sounder free-trader of the two. Let us hope that the Government, the House of Commons, and the public, will prefer reason to dogma.

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COPY OF CORRESPONDENCE.

1.

Mr. George Anderson, M.P., to the Secretary of the Glasgow United Trades' Council:—

Helensburgh, 6th September, 1878.

Dear Sir,—I have yours of the 4th, and am exceedingly sorry that such an enlightened and intelligent body as the United Trades' Council are thinking of getting up a "Protectionist" meeting. The movement in favour of the 'depressed sugar industry,' so far as I can understand it, is an attempt to get a tax upon foreign sugar against France because France gives a bounty on the sugar her refiners export. This would be nothing but "Protection" under the plausible name of "reciprocity." The result would be that the whole people of this country would have to pay a higher price for sugar merely to put money in the pockets of the sugar refiners. So long as France chooses to act so foolishly for herself as to make the people of this country a present of a million a year, let us take it. She is not likely to continue it very long. The result of the French system of protecting her sugar industry is, that the people of France are paying nearly twice as much, I am informed, for their sugar as our people have to pay for what they consume. Once begin protective taxes, and you may soon approach French prices, and I do not think the working men of this country are likely to relish that! With these views, of course, I cannot do anything to further such a meeting as you ask me to attend.—I am, &c.

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## 2.

Mr. George Anderson to the *Glasgow Herald*:—

“Glasgow, 19th September, 1878.

SIR,—I observe in your report of the proceedings of the Trades' Council last night, several allusions to a published letter of mine on the sugar bounty question, which seem to require from me some remark. Mr. Kennedy, the Secretary, says that my letter was in reply to one from him which was written by him, not as Secretary to the Trades' Council, but on behalf of the convener of a committee of that Council. That his letter spoke only of “exposing the iniquities of the sugar bounty system,” and said nothing at all about “Protection.” That I had, therefore, “jumped to the conclusion that the meeting was called for “Protectionist” purposes, in which I was. “not warranted by the letter of invitation.” I chanced to have kept Mr. Kennedy's letter, and I find he does say in it that he was “desired (to write) by the committee appointed by the Council to co-operate with the coopers in getting up a meeting on the depressed condition of the sugar industry of Great Britain, through the bounties paid to sugar manufacturers in France and other countries by their respective Governments.” His letter, however, is headed “Glasgow United Trades Council,” and it is signed as Secretary. It does not seem very material whether he wrote on behalf of the Trades' Council, or only on behalf of a committee of that Council if the committee was appointed not merely to consider the question, but actually to assist in getting up a meeting already agreed to by the Council itself. His letter certainly does not say anything of “Protection,” at least not directly, but neither does it speak directly of “exposing iniquities,” which he says it did, but alluding to the “depressed sugar industry.” I was as much warranted in supposing he meant to propose some remedy as that he meant “to expose the iniquities of the bounty system.” Besides that, there had just been a similar meeting at Greenock, at which a resolution had been passed in favour of a retaliatory duty, and I viewed with great disfavour the possibility of a similar resolution being carried, or even moved; here. The two resolutions that were brought forward last night, show that my apprehensions were not unfounded, nor my caution against it unwarranted; and if my letter has done anything it has surely not been as Mr. Clarke said, to bring “disgrace on the Council,” but rather to save them from, I will not say “the disgrace,” but the error, of committing themselves to a policy which I feel sure would not have been endorsed by their constituents—the working men of Glasgow. By last night's proceedings I understand the Council have agreed to go on with the meeting, but to limit it to a resolution of protest against the bounty system, and, so far as appears, remain silent as to either Free Trade or retaliatory duty. I would respectfully point out that a meeting to do nothing more than that will be useless

and valueless to the depressed sugar industry; but in another way it may be far worse than useless; its meaning is very liable to be misconstrued. Those who are in favour of a retaliatory duty may, through their speeches, give the meeting an appearance, and may not be slow to represent elsewhere, that its real meaning was in favour of such a duty. The present Government is, in all things, thoroughly reactionary, so far as it dares to be so. Their majority is equally so, and I think Sir Stafford Northcote's words seem to bear out that they only need a little encouragement, or apparent encouragement, from the country to be reactionary on this particular matter. If my words have any weight, I would strongly counsel the working men of Glasgow, if any such meeting is held at all, not to be content with a resolution against bounties, but to insist as strongly on a resolution condemning retaliatory duties or any similar plausible infringement of Free Trade.—I am, &c.

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3.

The Secretary of the British Sugar Refiners' Committee to the  
*Glasgow Herald*:—

October 12th, 1878.

SIR,—Two months ago you were good enough to permit me to reply to a letter which appeared in your columns in reference to this question. The subject has been discussed by several of your correspondents since that date, the most important of whom has been Mr. George Anderson, M.P. I beg a small space in your valuable paper to reply to certain points which have been raised in this discussion since the publication of my former letter. One writer points out that in sugar refining, as in other trades, the weakest have gone to the wall; mammoth firms have taken the place of small and scattered factories, and favourably situated towns have supplanted those possessing less advantages. From these facts he infers that the movement set on foot with the concurrence and hearty co-operation of every sugar refiner in the United Kingdom more than six years ago, for procuring the suppression of foreign bounties on the export of sugar, is not well founded. In reply to this I may add to the statement contained in my former letter by reminding your correspondent that one of the mammoth firms has already followed its weaker brethren by going to the wall, that the chairman of the committee entrusted by the trade with the conduct of this movement represent *the* mammoth refinery of the kingdom, and that the town which your correspondent represents as having come to the top in the natural process of the survival of the fittest was the intelligent originator of the agitation. I may further say that all those who have succeeded in that Darwinian struggle for existence which your correspondent has described believe that this competition with foreign subsidies to which they have been,

and are still, exposed would have been far more severe but for the check which the diplomatic pressure of the last few years has put upon the excessive growth of this bounty system. Moreover, be the trade of sugar refining in this country what it may, the fact remains as stated in my former letter, that we and our colonies are deprived by foreign export bounties of a further trade of fully 300,000 tons. Of course, your correspondent's argument does not affect the main point of our contention, which is that prices are depressed below their natural level by the foreign subsidies, and that consequently the cultivation of sugar in unsubsidised and naturally more favourable localities will be seriously curtailed, and thus involve an ultimate loss and injury to the consumer. In reply to my former antagonist, I need not add to my previous statement, except to say that I never alluded to the question of a countervailing duty, though I have always contended, and am prepared to maintain, that it would be, on abstract economical principles, a sound and perfectly free-trade measure. This brings me to the letters addressed by Mr. George Anderson, M.P., the one to the Glasgow United Trades' Council, and the other to yourself, and both published in your columns. It is, perhaps, not altogether surprising that an enthusiastic free-trader, too busy to consider the matter, should at first sight condemn the idea of countervailing the injurious effect of an export bounty by a corresponding import duty as "protection" under the plausible name of "reciprocity," increasing the cost to the consumer and putting money into the pocket of the producer. A member of Parliament is, however, I venture to submit, not justified in taking this offhand view of such a public question without examining and meeting the arguments on which the proposal is supported. It has been shown that the effect of bounty-fed competition must be to force the value down below natural cost price, and thus to substitute a precarious and artificial source of supply for one which is natural and certain, which must involve ultimate scarcity and high prices. A remedy for such an evil cannot be called "'protection' under the plausible name of 'reciprocity.'" Again, it has been shown that the neutralising of the bounty by a countervailing duty would simply restore prices to what they would be under natural conditions, while it would secure the consumer against the otherwise inevitable certainty of a reduced supply and consequent increased cost. This cannot be called "'protection' under the plausible name of 'reciprocity.'" Lastly, it has been shown that so long as the foreign export bounty is in operation a present is being made to the British consumer by the foreign taxpayer, and that so long as British home and colonial producers choose to carry on the competition they are compelled to contribute a similar present to the consumer out of their own pockets. The countervailing duty would relieve them of this tax, while it would secure the present made us by the foreign

country, only putting it into the National Treasury for the benefit of the whole body of taxpayers instead of allowing it to go to sugar-consumers only, to their own ultimate detriment and the injury of all unsubsidised producers. This cannot be stigmatised as "putting money into the pockets" either of sugar refiners or colonial planters. It simply restores both them and the consumer to the position they would be in if there were no bounties and every one were free to produce and procure sugar where it could be grown and refined in the best and cheapest manner. I must leave my reply to the rest of the correspondence for another letter.—I am, &c.

## 4.

The Secretary of the British Sugar Refiners' Committee to the  
*Glasgow Herald*:—

October 15th, 1878.

Sir,—It is so important, in the interest of economical principles no less than in that of the industries affected, that this question should be clearly understood, that I venture to continue the reply to Mr. Anderson which you kindly inserted in your yesterday's issue. Mr. Anderson uses the words "protection," "reciprocity," and "retaliation." The question is, how they apply to this subject. The old duty on corn was "protection" to the British farmer; it was condemned because it prevented the consumer from availing himself of other sources of supply, and gave an artificial support to the home industry. Free trade was established in order that the consumer might be relieved from this disability. The foreign export bounty on sugar is reducing the natural sources of supply; unsubsidised producers cannot in the long run compete with those who receive a bounty. This is proved by the throwing out of cultivation of West Indian estates, and the enormous increase in the production of bounty-fed beetroot sugar. The consumer is therefore being deprived of his natural sources of supply, and gradually placed in the power of an artificial monopoly. A foreign export bounty, therefore, has the same effect as a home protective duty on the British consumer. Neutralising the effect of a foreign bounty is therefore equivalent to abolishing a protective duty. In each case free trade is restored, because the consumer is enabled to avail himself of those sources of production which are naturally best and cheapest, and thus to secure a stable and permanent supply at the lowest natural cost. A duty which would just countervail the bounty would neutralise its effect, and would therefore abolish the injurious effects of protection and restore free trade. To stigmatise such a policy as "protection" is therefore a misconception of the facts of the case, or an erroneous interpretation of the recognised meaning of the term.

"Reciprocity" is invoked by those who contend that we should not give

our consumers full facilities for procuring their commodities from the best sources, unless foreign nations do likewise. They ask that we should 'retaliate' by shutting out the goods of those producers who refuse to receive ours. The foolishness of such a policy is manifest on the face of it; but how can it be said that countervailing the injurious effect of a foreign bounty bears any analogy to it? A retaliatory duty is simply a return to the old policy of protection. I have shown that a countervailing duty simply restores matters to the state in which they would be if there were no bounty, no injury to the natural unsubsidised producer, and therefore no disturbance to the freedom of trade. There is no question of reciprocity or retaliation in the matter.

Mr. Anderson goes on to say that as long as France chooses to give us a million a-year we ought to take it. No one ever proposed that it should be refused. A countervailing duty would secure it in the National Exchequer, and thus relieve the whole body of taxpayers to that amount, and at the same time restore to the consumer those natural sources of supply which would otherwise be eventually cut off from him, and thus ward off from him ultimate scarcity under the unstable supply of an artificial monopoly.—I am, &c.

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## 5.

The Secretary of the British Sugar Refiners' Committee to the *Glasgow Herald*:—

Inverness Station, October 16, 1873.

Sir,—I have to thank you for giving such prompt insertion to my letter, and for the additional prominence you have afforded it by a reference in your editorial column. I cannot take it as otherwise than a compliment that in your remarks on the subject—unfavourable as they are to the cause I uphold—you avoid dealing with my arguments. Unfortunately for my trade, your observations will be read by thousands, my letter by few. It is, no doubt, easy to pick holes in a claptrap manifesto, and to deal with the injurious misstatements of our enthusiastic friends and champions, the working-men. I need not follow you in that direction, and am quite ready to admit with undisguised regret that our cause is much damaged by the exaggerations which you have been quick enough to lay hold of. Nevertheless, I believe I have succeeded in showing in former letters that the men now agitating have a good case, in spite of their unfortunate habit of distorting it. No amount of depreciating criticism can get rid of the fact that any foreign competition which is subsidised must rob us of what would otherwise be a part of our trade and industry, and must, therefore, deprive the working classes of a channel for their labour. These are not times when we can afford to be so ousted, and it is clearly the duty of statesmen in this



period of depression to see that no artificial obstruction like that which stands in the way of our home and colonial sugar trade should be allowed to continue. You say we are not so badly off as the coal and iron trades. Possibly not, but still we have a tangible and remediable grievance which they have not. A subsidised competition is a national injury, put the matter how you will; if it can be got rid of with injury to no one, but, as I have previously shown, with great benefit to all concerned, and to the advantage of the nation at large, it is difficult to understand why our cause should meet with such opposition as that contained in your remarks. You question the existence of a bounty. I could, were the materials at my hand, give you columns of extracts from French official documents, Parliamentary debates, pamphlets, and newspapers, which would sufficiently convince you that even in France itself the existence of a bounty ('prime') is fully admitted. You are right in saying that there is no export bounty on French raw sugar. It is the bounty that German, Austrian, and Russian raw sugar enjoys which is also so seriously injuring our West Indian colonists. This competition has to be added to that of the 300,000 tons of refined beetroot sugar which, under normal conditions, would be made from cane sugar. You are informed that French loaves would, under any circumstances, compete favourably with ours. This is not the case. Without a bounty it would be impossible for French loaves to be shipped at the prices now ruling. We want, you say, the skill and science of the Continent. On this point, again, I venture to modify your assertion by pointing out that there are, even yet, one or two makers of British loaf sugar surviving who have succeeded in doing so against subsidised competitors, purely owing to superior skill and science. You point to the success of the makers of crushed and soft sugar in this country, and the increasing exports of that kind of sugar. But how do these facts compensate us for the ruin of loaf sugar makers, and the loss of the enormous export trade we ought to have to those countries which use only loaf sugar? or why should France and Holland supply us with nearly all our loaf sugar, which would, under natural conditions, be made at home out of our own colonial sugars? As to our exports, they are precarious and deceptive. We export no hard sugar. Two-thirds of the quantity exported is soft sugar for Canada. It has gone there because Canadian legislation and a recent bounty in the States have shut up every refinery in Canada. The bounty in the States, and the frauds by which it was supplemented, have been exposed and stopped; Canadian legislation will change with the new Ministry, and we shall find next year that our petty export trade of 40,000 tons has been reduced by 25,000 tons. You ask what is meant by the sum in hand which assists in enabling the French refiner to handicap us. It is the two or four months' credit on the duty given him by his Government, which is equivalent to supplying him with his working capital. So

long as you are not convinced that these bounties are a national injury to us, and that steps for countervailing them would be a return to free trade and not to protection, I can quite appreciate your sense of duty in opposing our views, and am in no way aggrieved at your doing so. I trust, however, should you have occasion again to call attention to the subject, that you will deal with the arguments we have adduced. I cannot so easily understand the motives of some of your correspondents, who, without sufficient knowledge of the question, endeavour to depreciate and whittle away what would appear to ordinary outsiders a very strong and a very hard case. Your correspondent "N." is bold enough to say that if there was a bounty he would be prepared to support a countervailing duty. He ought, then, to be on our side, for now not even the French refiners themselves deny the existence of a bounty. They and M. Léon Say, no doubt, try to make out that it is very small, but a former Finance Minister, who went very fully into the subject, put it at twenty million francs. But your correspondent goes on to admit that the bounty exists, and then dogmatizes by saying, without an atom of proof, that it has no injurious effect on our trade. Even those who never heard of the subject before would be a little puzzled to understand how we could face competitors receiving a subsidy from their Government without being injured by them. Such a state of things is a simple impossibility. Then he says—again dogmatically—that we cannot compete with the foreigner. As the foreigner has never yet been unsubsidised, it is difficult to understand what means the writer has had for making this discovery. Then he goes into the question of refining in bond, and asks why, if the refiners really believed they were being injured, they did not adopt the principle themselves. How this would have removed a vicious system existing in another country he does not explain, and he carefully abstains from any mention of the fact that when they began to feel the shoe pinch, and knew that they were competing against heavy odds, they unanimously memorialised Government for a new Convention based on refining in bond, and not only declared their willingness to be placed under such a system, but undertook to bear the expenses of its establishment and maintenance! With such facts as these, and those which I have stated in former letters, it is rather hard to have the *bona fides* of the movement called in question by anonymous statements unsupported by any proofs and contrary to the facts.—I am, &c.

## 6.

Mr. George Anderson, M.P., to the *Glasgow Herald*:—

Glasgow, 16th October, 1878.

Sir,—I observe that Mr. Martineau, Secretary to the Sugar Refiners, has in a letter in your columns addressed himself to the task of replying to

some letters of mine, in which I had deprecated the action of the United Trades' Council in lending their influence to an agitation which, so far as it had then gone, had showed itself to be in favour of a retaliatory duty on foreign refined sugar. The Trades' Council at that time appeared to be indignant at the very idea that they could be thought to be doing so, and some of them specially repudiated that part of the programme; but now Mr. Martineau shows that he and his association do mean it, or why does he send that letter to appear just before the meeting, the principal part of the letter being the advocacy of such a duty? It strikes me that it would be well for those attending the meeting to know who are its real promoters, or who pays the cost of it. If it be the sugar refiners they will evidently want a resolution for a retaliatory duty, and the Trades' Council will either have to throw over the real promoters, or will put themselves in the unfortunate position of making a move decidedly hostile to free trade principles. I most strongly hope, for the credit of Glasgow working men, they will keep out of that blunder.

Mr. Martineau's letter impresses me with the idea of a man who begins on a small grievance, and as the constant advocacy by degrees impresses himself and magnifies the grievance, he at last fully believes he has a very great grievance indeed! Thus he has got to call what is a "drawback" a "bounty," and then a "subsidy," and so you will observe in this letter he carefully avoids "drawback," and speaks of "unsubsidised producers" as against those who receive "foreign subsidies." Just as if it were the system of foreign Governments to pay some regular subsidy to their refiners "for the purpose of handicapping British refiners in their own markets." I don't know if Mr. Martineau is sponsor for this quotation, but it is from the bill calling the meeting, and is suggestive of that. Your own article to-day sufficiently exposes the "subsidy" fallacy, and I shall only say that if the promoters of this agitation had been a little more candid in explaining what it really was, and had played a little less with the misleading words "bounty" and "subsidy," I for one would have given them more credit.

Except for the above most exaggerated and unfair way of speaking, Mr. Martineau puts his case as well as a bad case would admit of, and I don't object to his justifying his own existence by telling us how much worse matters would have been but for the "diplomatic pressure," which I believe came greatly from his association. I am a cordial well-wisher to that diplomatic pressure, it is the right way to go to work, and I hope it will succeed in bringing about the fulfilment of all the arrangements of the sugar convention. But as for the suggested alternative, a retaliatory duty, I am far too unwavering a free trader for that, and simply brush aside the sophistry with which Mr. Martineau seeks to defend it.

If even it were expedient, it is not practicable. We now see that it is not

really a fixed or known "bounty" or "subsidy" that is given to anyone, but only an uncertain and varying gain on some sugars; that is, on those only that can be coaxed into producing more refined sugar than, in charging the duty, they were expected to give. How is Mr. Martineau to fix the rate of his countervailing duty, so that it shall be in every case neither more nor less, but exactly the same as the foreign refiner has succeeded in cribbing from his Government? It is quite idle to pretend that anyone but the foreign refiner himself knows exactly what he can make out of the drawback; and I think Mr. Martineau will himself admit that any higher rate would, even in his view, be a violation of free trade principles.

I quite admit that any profit that acts in any way like a bounty does make a present to the sugar consumers of this country, and interferes with the natural prices; but I deny that the countervailing duty would either restore natural prices, or would, as Mr. Martineau asserts, "secure the present made us by the foreign country, only putting it into the National Treasury for the benefit of the whole body of taxpayers, instead of allowing it to go to the sugar consumers only." I should suppose those two bodies nearly indetical, but must point out that "putting it into the National Treasury" is just the last thing the duty would do, if it fulfilled the intention of its promoters; for what they want is to prevent, or at least check, such sugar from coming in to so great an extent as it now does, and clearly, if it did not come in, it could not "put the duty in the National Treasury."

I sincerely hope the result of the meeting to-morrow night will show that whatever sympathy may be due to the sugar refining industry by the working men of Glasgow, they are not to be tricked into any departure from free trade principles, and that so far as agitating for a retaliatory duty, "the sugar bounty bubble" has burst.—Yours, &c.

## 7.

The Secretary of the British Sugar Refiner's Committee to the *Glasgow Herald*:—

21, Mincing Lane, London, November 4, 1878.

SIR,—I have been too much out of the way of newspapers to be able till now to notice Mr. Anderson's letter of the 16th ult. I will, if you kindly permit me, reply to one or two of his remarks. He begins by imputing motives. I had nothing whatever to do with the meeting, and knew nothing about it till a few days before it was held. He still persists in calling a countervailing duty "retaliatory" and "hostile to free-trade principles," though I have shown in my previous letters that it is neither the one nor the other. Fortunately Mr. Anderson's colleague, in his able speech, has proved this more conclusively and in much more forcible language than I

can hope to do. His convincing argument brought about what Mr. Anderson calls a blunder, and which he hopes, "for the credit of Glasgow working men," they will not fall into—a resolution in favour of a countervailing duty. Mr. Anderson says that I began on a small grievance. What grounds he has for this assumption he does not state. Facts are very much against it. A question which has occupied our Government and those of every important European country for the last fifteen years, which has involved eight International Conferences, several important commissions of inquiry both here and abroad, a mass of diplomatic correspondence, and constantly repeated and most influential deputations to Government from all classes of home and colonial sugar producers, manufacturers, and dealers, can hardly be called a small grievance. Mr. Anderson accuses me of having invented the word bounty. I beg to refer him to the blue-books on the question as far back as 1863. I think he will find the word bounty even in large capitals on the title-page. He will also find it in nearly every copy of the *Journal des Fabricants de Sucre*, or of the *Sucrerie Indigène*, or of the *Sucrerie Belge*, or even of the trade newspapers of Germany and Austria. It is hardly fair that those whom Dr. Cameron in his recent speech so well described as worshippers of a fetish which they are pleased to call free trade should evade fair argument, and fall back on assertions so completely contradicted by facts. If Mr. Anderson were acquainted with the subject on which he presumes to make such statements he would know that it is notoriously admitted on all hands, even by the interested parties themselves, and constantly stated in public prints abroad, that the foreign fiscal systems in regard to sugar are intended to convey a bounty, subsidy, excessive drawback, protection, advantage,—or any other word which Mr. Anderson may prefer,—to the foreign exporter. In proof of this I will give one or two extracts—the first that happen to come to hand. The Belgian Finance Minister, in one of his speeches on the subject, uses these words—"The enormous bounties enjoyed at this moment by the French refiners, give them now the command of the market for raw sugars. The industry of the raw sugar manufacturers is now suffering from the great depression in the market for their produce, and that depression is principally caused by the bounties which exist in France." Two years ago M. Toe Water, one of the delegates of the Dutch Government at the International Conferences, wrote a letter in a Dutch newspaper against the sugar bounty in Holland. He said that at one time the bounty was so great that nearly all the duty went as bonus to the manufacturers. That was before the French competition sprang up, and when the Dutch refiners had entire command of the export market. He goes on to state that at present, of the annual importation and production of the country, amounting to 120,000 tons, 6 per cent.—i.e., 7200 tons—escape the duty, causing a loss to the Treasury of 1,800,000 florins.

He declares that "this is the only industry in Holland which receives such protection, and is thus fostered by artificial means." Lastly, let me give Mr. Anderson an idea of what the French themselves say. One of the delegates who have represented the French Government at the International Conferences, in a report to his Government in the year 1873, makes the following startling statement:—"The system of sugar duties was invented to give bounties to the refiners. The refiners have never been subjected to supervision; it would be an unheard of thing that they should now be subjected to it for the first time." After such an avowal from the leading official connected with the sugar duties in France, we need no longer discuss the question of the existence of a bounty which has formed the subject of continuous negotiation for the last fifteen years. It is an official with these views that the French Government selects to represent it at Conferences ostensibly held, and even invited by France herself, in order to suppress bounties. In spite of this determination in official quarters to maintain the bounty, the National Assembly in the following year declared that bounties should cease and that the refiners should be placed under supervision. Surely this fact, again, is a sufficient admission of the existence of the bounty to satisfy the doubting mind of Mr. Anderson. Here is what the reporter of the Budget Commission said at that time—"Duty on consumption, by supervision of the refiners, can alone remedy in an effectual manner the abuses at present existing; first, by insuring the receipts of all sums due to the Treasury; secondly, by establishing a just equality between the two great branches of the sugar industry; thirdly, by suppressing in an effectual manner the indirect premium on exportation." And yet, thanks to the incubus of official resistance, these virtuous resolves, and the actual law passed in 1874, have never been carried out. Such proofs of the existence and full admission of a bounty I could multiply *ad libitum*; but these are, I think, enough and sufficiently conclusive. Having endeavoured to cut the ground from under me by suggesting that I am fighting a shadow, Mr. Anderson goes on to admit that the diplomatic pressure which has been brought to bear for the suppression of these bounties is the right way to go to work, and he cordially hopes that it will "succeed in bringing about the fulfilment of all the arrangements of the Sugar Convention." For these good wishes, I and my colleagues thank him most heartily. It is solely in order to secure this success that we support the proposal of a countervailing duty; and we should not think of doing so were we not convinced that such a measure would be, as Dr. Cameron puts it, "in exact accordance with the fundamental principle on which the whole theory of free trade is based." I have, to the best of my ability, endeavoured to state our grounds for this opinion. The arguments we have used have been stated repeatedly in various quarters and before very competent

judges for several years, and I unhesitatingly assert that though many have, like Mr. Anderson, contented themselves with "simply brushing aside the sophistry," of our reasoning, no one has ever attempted to confute it. I do not know how far the simple brushing aside of arguments difficult to deal with may answer in Parliamentary life, but I should doubt the success of such a system with those who aspire to become statesmen. Mr. Anderson questions the accuracy of my statement that a countervailing duty would "secure the present made us by the foreign country, only putting it into the National Treasury for the benefit of the whole body of taxpayers instead of allowing it to go to sugar consumers only." I beg to remind him that it is an argument in support of the principle of a countervailing duty, and part of the answer to those who oppose such a policy on the ground that if France chooses to make us a present we ought to accept it with thankfulness. These opponents—Mr. Anderson among the number—all declare that "diplomatic pressure" is the right course, and give us many good wishes for its success. They desire that we should deprive the consumer of this temporary present made to him if we can do so by negotiation, but not by a countervailing duty. We reply that the countervailing duty will either lead to the success of the negotiations they approve, or will secure the benefit of the present they are loathe to part with. In the latter case it will at the same time stop the ultimate injury which both consumer, and producer would otherwise inevitably incur.—I am, &c.

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## THE SUGAR CONVENTION.

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### THE NEGOCIATIONS OF 1877-1878.

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#### I.

#### MR. WALPOLE'S MISSION TO THE HAGUE.

"Further Correspondence respecting the Sugar Question" (Commercial No. 20, 1878,) has just been published, giving a tolerably full account of the negotiations from the close of the Conference of March, 1878, to the present time. An examination of these documents will show that the whole matter would have been satisfactorily settled before the end of last year but for two circumstances, the one remediable, the other unavoidable. The change of Ministry in Holland, coupled with a serious political crisis in France, were matters over which our Government and

those who watched the progress of events in the interests of the trade could have no control. But the sudden and unaccountable removal of the conduct of the negotiations from the hands of Mr. Walpole, who had during the previous two years given so many proofs of his ability and had brought the matter to the verge of a successful settlement, conduced in no inconsiderable degree, as we shall point out, towards the present unfortunate, but it is to be hoped only temporary, triumph of the obstructionist party abroad. This and previous blue books abundantly illustrate the necessity of having a matter of this kind conducted by one willing and able to make himself master of difficult details, competent to grapple with constant and subtle opposition, and sincerely anxious to succeed. When, in the beginning of 1875, the Government selected Mr. Walpole to represent them at the Conferences of that and the two following years, and furthermore permitted him to conduct the negotiations supplementary to those debates, they, fortunately for the interests of the home and colonial sugar trade, found such a man. He was instructed at the outset to consult the trade as to the details of the question, and to permit them to be cognizant of the progress of the negotiations, so that a complete and satisfactory co-operation might exist between the Government and those for whose interests the negotiations were instituted. Mr. Walpole has, throughout his period of office, acted on this principle; the result being the constant success of the arguments advanced and the policy suggested by this country, in spite of every effort at obstruction on the part of certain foreign officials. Prompt action whenever fresh difficulties were raised, and the doing of the right thing at the right time, had brought these long and difficult negotiations to the very verge of success, when, early last year, and at the most critical part of a discussion with the Dutch Government which Mr. Walpole had up to that time carried on single handed, he was removed from taking any further part in the matter, the conduct of which was evidently assumed by the ordinary officials of the commercial department of the Foreign Office. These gentlemen, if they instead of Mr. Walpole had been entrusted, in 1875, with the conduct of the affair, and if they had



shown the same disposition to master difficult details and to overcome constant and troublesome obstacles, might, no doubt, have been equally successful, and would have been competent to bring the matter to a satisfactory conclusion. Under the circumstances it is clear, as shown by the result, that they could be no match for skilful and determined adversaries. An end of a troublesome business was evidently more to their mind than the success of another man's labour and skill.

The present volume of despatches commences with Messrs. Walpole and Le Feuvre's report of the results of the Conferences held in Paris in February, 1877. Lord Derby, in a letter to Count de Bylandt, summarizes these results as follows:—

“I have to add that Her Majesty's Government consider the proposed Convention a great improvement upon the draft Convention of 1875,

“1. Because it places beyond question the right of each country to abolish the sugar duties.

“2. Because it relieves the refiners from supervision in the interior of the refineries.

“3. Because it gets rid of the French regulation for taking a preliminary duty on sugar entered for exportation, which will, in the opinion of Her Majesty's Government, render a strict supervision over the refineries indispensable.

“4. Because, by Article V. relating to Belgium, the yield of the sugars of the second-class is raised, and it contains a provision by which a further reduction of duty may be effected at the expiration of two years.”

On the 3rd April, 1877, Count de Bylandt communicates to Lord Derby a memorandum of the Dutch Government, criticizing certain points in the draft Convention. Lord Derby, in his reply, states that “it has been considered advisable to answer this memorandum in the form of a tabular statement, setting forth, side by side, the objections raised by the Netherlands Government, and the views of Her Majesty's Government thereon.” This statement is spoken of as enclosed in Lord Derby's reply, and as Lord Derby says that “the memorandum in question refers to matters of a very technical

nature," it is evident that the reply must have been drawn up by Mr. Walpole. It is, for some unexplained reason, excluded from the blue book, and we are left in the dark as to the nature of the answer of Her Majesty's Government to a very important document.

On the 28th of April, 1877, the Foreign Office is informed that the Netherlands Minister has brought in a bill for prolonging the existing law as regards the beetroot factories until July, 1878.

On the 3rd May, 1877, the Dutch memorandum and our reply are sent to Lord Lyons, "for your Excellency's information," but with no instructions to communicate the same to the French Government, as would have seemed the natural course, in order to enable Lord Lyons to smooth over the differences between France and Holland.

On the 4th May, 1877, Sir E. Harris, who has always shown a lively interest in the question, and done all in his power to remove obstructions in Holland, writes to say that he has not yet seen the Memorandum sent by Count Bylandt to Lord Derby a month previously. Thus the natural step of immediately acquainting Sir E. Harris with the difficulties raised by Holland, and the elaborate reply of the British Government, in order that he might do all in his power, in friendly conversation with the Dutch Minister, to remove the obstruction, was neglected. Admiral Harris states his belief that the Netherlands Government are anxious to pass a Convention, but adds that they have no majority in the Chamber, and that it is doubtful whether they will obtain one in the coming elections. "It is to be expected," he says, "that, after the concessions which have been made, the States General will not throw away the chance of settling the question."

The hitch in the negotiations caused by the Dutch Memorandum, and aggravated by the want of prompt action on our part, led to strong representations from those who acted for the trade, which resulted in Mr. Walpole being sent to Brussels and the Hague to endeavour to arrange matters. In this he was remarkably successful. His despatches of May 9th, 12th, and 15th describe how he obtained from the Belgian Government the concessions desired by Holland, and how, after repeated interviews with the

Ministers for Foreign Affairs and Finance at the Hague, and M. Uttenhooven, "the official adviser of the Government on this question," he succeeded in completely removing the difficulties that stood in the way of the acceptance of the Convention by the Dutch Government, and this in spite of the fact, as stated in his despatch of May 12th, that M. Uttenhooven "is extremely antagonistic to the Convention, or indeed to any Convention, and evinced no disposition to facilitate an arrangement." In stating the results of his final conference with the two Ministers and M. Uttenhooven, Mr. Walpole says: "The Netherlands Ministers were evidently indisposed to support M. Uttenhooven (who, it appeared, is the author of the Memorandum referred to) in his objections to the Convention; and, after a conference which lasted two hours and a half, they expressed themselves satisfied with the concessions offered by M. Malou in regard to Article V., and declared that they withdrew all the other objections raised in the Memorandum, except so far as relates to Article III." The following day he saw M. de Willebois, the Foreign Minister, who stated "that he considered Mr. Walpole's visit to Brussels and the Hague had been of great advantage, and that the Netherlands Government now saw their way to the acceptance of the Convention. They were satisfied, he said, with regard to Belgium, they completely withdrew the objections contained in the Memorandum to Articles VIII. and IX., and that, as regards Article III, the Netherlands Government would not ask for any sensible modification of the Article which might give rise to difficulties with France, but only for modifications thereof or explanations as to the manner in which the French Government proposed to carry it out, with the object of being able to meet objections which it might otherwise give rise to in the States General." He concluded by promising to communicate at once with the Belgian and French Governments, "with a view of bringing matters to a satisfactory issue," and added that "should any difficulties arise with France he would confer with Admiral Harris with the view of obtaining the co-operation of Her Majesty's Government." It will be seen in the sequel that if that co-operation had been

rendered at the proper time and in an intelligent manner, any failure to agree would have been attributable to unreasonable conduct on the part of France not of Holland. With reference to this mission of Mr. Walpole, Sir E. Harris writes : " His visit has been of great advantage towards a settlement of the sugar question, from his perfect knowledge of its details. \* \* The concessions which Mr. Walpole brought with him from the Belgian Government naturally produced a good effect ; and I was glad to observe that M. de Willebois had not only mastered the details of the question, but was disposed to treat it in a frank and loyal manner. The result has been that the Dutch Government withdraws the objections to Articles III., VIII., and IX., so that practically the only point requiring to be arranged is some slight alteration of Article III., or an explanation thereof by the French Government, in order to enable the Dutch Government to meet any objections which may be raised to it in the Chambers." Lord Derby, in acknowledging the receipt of Mr. Walpole's last despatch, says : " I entirely approve the manner in which you conducted the recent negotiations at the Hague for securing the acceptance by the Netherlands Government of the terms of the draft Sugar Convention."

From this point Mr. Walpole disappears from the scene, the foreign obstructionist officials become masters of the situation, every opportunity for clearing up misunderstandings and removing trivial objections is neglected by our commercial department for foreign affairs, and the result is a most unfortunate series of mistakes and delays which a very little management would have averted.

*(To be continued.)*

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## THE BOUNTY QUESTION AT THE SOCIAL SCIENCE CONGRESS.

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The twenty-second Annual Congress of the National Association for the Promotion of Social Science was held this year at Cheltenham, from the 23rd to the 30th October.

The President of the Congress was Lord Norton, whom our readers will more generally recognise as Sir Charles Adderley.

The Vice-Presidents of the Congress included Mr. Bonamy Price, the Professor of Political Economy at Oxford. The learned Professor presided over the Department of Economy and Trade. Among the papers accepted by the Council of this department was one by Mr. Wallwyn Poyer B. Shephard, of Lincoln's Inn, upon "The Economic Operation of Foreign Sugar Bounties."

The writer attended the Congress, and read his paper at the Rotunda, Mr. David Chadwick, M.P., presiding during the temporary absence of Professor Bonamy Price. Lord Norton was also present on the platform.

Mr. Shephard, after having pointed out and explained the origin of the bounty, verifying his statements by quotations from official and other documents, thus indicated the adverse operation of this form of protection on our tropical sugar-cane industry:—

"It is in the markets of the world that producers seek to recoup themselves the cost of production. All great centres of industrial production have a staying power in their resources of capital and credit, which enables them to withstand those natural fluctuations in prices which arise from the varying conditions of the ratio of supply and demand. But although the contingencies, arising from natural causes, can be reduced by experience to some law of average which may be relied upon the disturbing influence on market values of the arbitrary force of State intervention cannot be safely estimated for commercial purposes. It is a disturbing force of unknown and potent, and the more potent because unknown, power. This disturbing force is now in full operation on the sugar markets of Europe. Operating on our own markets, it works backwards through every ramification of our sugar industry. It crosses the Atlantic, and causes the British capitalist to pause ere he invites the swarthy coloured labourers of the West Indies to gather in the prolific bounty of tropical vegetation.

"Thus England loses surplus wealth, which, coming from her own land to her own citizens, is as a gift from nature to the nation—an economic consequence which has not received the attention it deserves in that department of State which was instituted to watch over the commercial and industrial welfare of the colonies.

“Foreign protection, in the form of export bounties, inflicts, moreover, a grievous wrong upon English producers; they are compelled to provide out of their own profits—already adjusted to a minimum by free competition with the whole world—the equivalent of these foreign bounties; unless they can do this, they must withdraw from their own markets. It is this exaction which has closed so many English and Scotch refineries, and retarded cultivation in our West Indian possessions. But the consumer has bought sugar a trifle cheaper, and thus a condemned and pernicious form of protection has actually raised in some minds an apparent conflict of interests between English consumers and English producers. Herein lies the gordian knot of the whole controversy. Some writers in the press urge that we are foolish indeed to quibble at the Continent taxing itself to give us sugar below cost price. These writers do not point out that State aid to foreign exporters operates as a tax on English producers, payable out of their own profits and wages, and that it is the competition of English producers which compels the foreign protectionists to yield up, on the English market, a greater or less proportion of the bounty to the English consumer.

“These writers, possibly, suppose that by such an *ad captandum* view they may emancipate themselves from the necessity of attempting to master the details of an intricate and troublesome question. But the Chancellor of the Exchequer, in his reply to a deputation of sugar operatives in June last, distinctly repudiated any participation by Her Majesty’s Government in such views as these writers have put forward, ‘he entirely dissented from them.’

“The freedom of production, in its exemption from all state hindrance or aid, is as essential a principle as the freedom of distribution and exchange. If the producers on the continent have equal or greater natural advantages than our own producers, no protection would be necessary to enable continental producers to compete with us in the English market. If, on the contrary, the stimulus of state protection is required to enable foreign sugar to be exported to this country, the position of our producers is as much reversed in the English market as if they were naturally

inferior to their continental rivals. It must not be supposed that foreign Governments view with indifference the disastrous consequences which will ensue to their own revenue, and to their own consumers, if this costly stimulus to exportation of their own indigenous sugar is to be continued for an indefinite period. Great indeed is their responsibility in permitting an artificial trade to widen and deepen its channels year by year. Hitherto the fate of this foreign export protection has depended on the forbearance of our Government. What if our Government were to intimate that on and after a given date, and so long as bounties were continued, they would be intercepted at our ports by a countervailing customs duty! One farthing per pound levied against raw beet and refined sugar exported under a bounty would either stop bounties or else yield us a revenue derived from foreign states; and if bounties were increased, the duties would increase also, and thus we might permit foreign states to contribute to our revenue. Not one farthing of such a duty would fall upon English consumers. It would all be paid out of the bounty it intercepted, the duty of course ceasing with the cessation of the bounty.

“Cobden once lamented that there were so few heads which could understand a simple proposition in political economy. It does seem surprising that this effectual method of either suppressing foreign bounties, or transferring them into our revenue, should have been so utterly misunderstood by many of our public men and writers in the press. There is not wanting an indication that our hesitation to levy such a duty has rendered fruitless the efforts of the Governments of France, Belgium, and Holland to put an end to the bounties, for M. Teisserenc de Bort, French Minister of Agriculture and Commerce, and the President of the Conference on this question, held last year in Paris, intimated most clearly to Mr. Walpole—the British Delegate—that his declaration that the British Government would not bind themselves to adopt ‘efficacious’ measures against export bounties from other nations in the event of France abolishing them, ‘compromised the ratification of the draft Convention by the French Chamber,’ adding that, in that case ‘England must bear the responsibility of the abandonment of the

conventional arrangement.' The real impediment to the Convention came from Holland. Still the opinion of M. Teisserenc de Bort is very important.

"It must be remembered that continental Europe seeks on our markets an outlet for that surplus production of beet sugar, which is the disastrous consequence of artificial stimulus. But we, as a nation, have this interest, viz., to see that our tropical possessions are not restricted in their power to supply us with their surplus wealth—the very gift of nature's sun and soil.

"It is not difficult to perceive that if the international sugar production and trade of Europe were permitted to follow its natural course, our tropics would yield a tribute to this country of ever-increasing annual value, a tribute from nature distributable to every citizen, by increasing the national capital, and, through such increment, the wage fund and purchasing power of the community. The West Indies and British Guiana have long poured an unceasing stream of wealth into this country, which, but for the adverse influence of European protection to beet sugar, and the continuance of slavery in Cuba, would rapidly increase. The Calendar of State Papers contains a significant entry of a letter from Comr. Thomas Middleton to Samuel Pepys, bearing date Sept. 10, 1665, stating that 'a ship had arrived from Barbadoes laden with sugar, sent as a present to the King.' Barbadoes was then, and has since then been, and still remains a source of net wealth to England. A fair specimen of the economic advantage to this country of English citizens settling in the tropics under a sound form of Government, and cultivating tropical acres.

"'The fruits of Portugal,' writes Addison in the *Spectator*, 'are corrected by the products of Barbadoes.' Such form of production converts, as it were, tropical acres into English soil.

"England, therefore, has this paramount interest in the international sugar trade, viz., the establishment of the fiscal system of Europe on such a basis that no protection to foreign competitors shall close British markets to her own producers.

"The attempts to ally the interests of English consumers with foreign protectionists, by the *ad captandum* view before referred to,



has been so far successful hitherto, that our Government, although repudiating the view, has nevertheless hesitated to adopt the only efficacious means for securing 'The Equity of International Taxation,' viz., the imposition of countervailing duties against foreign bounties.

"Ignorance of the real economic aspect of the question has originated much confusion of its real merits. Maxims quite inapplicable about 'retaliation,' 'war of tariffs,' 'revival of protection,' 'reciprocity fallacies,' have served as the texts of sundry lectures to all engaged in the British sugar industry.

"The consumers of to-day do not enjoy England without 'impeachment of waste,' and have, therefore, no right to insist on the maintenance of an artifice, however profitable to them, which tends to deprive consumers of to-morrow of their right of access to the natural, and therefore cheaper, sources of supply.

"This paper has treated the question upon economic considerations alone. Social questions of high import are, however, involved in the displacement of large masses of skilled labour from natural channels of industrial employment. The general commercial depression over us at this time operates on the sugar trade as well as on all our industries. But be there commercial depression or commercial prosperity, a 'constant quantity' of abnormal disadvantage will press upon our sugar industry so long as foreign export bounties continue to influence the natural price of our markets. The whole of our tropical sugar production is rendered dependent upon the caprice of Europe. Our sugar supply is being concentrated in an area so limited that the meteorological fluctuations of the crop seasons cause violent fluctuations in our markets.

"The subjects of Her Majesty engaged in the sugar industry demand no more than that the free trade ports of England shall lead to free trade markets for all comers, and shall not be closed to England's merchantmen and her industrial army of sugar producers by means of Foreign State Protection to foreign producers."

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In the discussion which ensued, stress was laid on the advantage to England of being able to obtain sugar on such favourable

terms for the consumer. Mr. Chadwick considered that the English sugar industry was entitled to every sympathy, but that no other remedy remained than that the people of France should be informed what a folly they were committing in taxing themselves to give us cheap sugar. Any other course he (Mr. Chadwick) considered was forbidden by our free trade policy. Mr. Shephard briefly replied to the several speakers, stating that he should be prepared to defend his views as a free-trader at any time before a jury of economists, when possibly he would turn out a better free-trader than Mr. Chadwick, who had allied the interests of the English consumer with those of the foreign protectionist.

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#### A SUGAR CONFERENCE IN PARIS.

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On the 14th of September, a Sugar Conference was held in one of the halls of the *Trocadéro*, by Professor Vivien, assisted by MM. G. Adam, F. Bourey, Champonnois, Corenwinder, Dumoulin, Dureau, and Linard.

The able professor first gave a short resumé of the history of the manufacture of beetroot sugar. He considered Archard as the true creator of this industry, in 1796, in Prussia, and he recounted the efforts and success of Benjamin Delessert, in France, in 1812, who produced the first loaves of beetroot sugar, after five years of study and research. Napoleon I. visited his refinery at Passey, and the decrees, issued several days after, (12th January, 1812,) lavishing all sorts of encouragement on the new industry,—creating four school factories, in which were entered as pupils 100 young men taken from the schools of medicine, pharmacy, and chemistry,—gave it a great *eclat*; and native sugar was soon produced in nearly all the French departments, fostered, as it was, by the high price sugar had attained on account of the continental blockade. The end of this blockade was certainly a great happiness for France, but it struck a fatal blow at the new-born industry. The orator then explained the constitution of sugar. Crystallised sugar, called *cane-*

*sugar*, is a body composed of 42.1 parts of carbon and 57.9 parts of water—that is to say, of two bodies spread in profusion over our globe. But of this body, of which chemical analysis can separate the elements, the synthesis cannot combine together again. Nature—the vegetable life—employs for this purpose some mysterious forces which science cannot bring into operation. It is, therefore, to the cane, the beetroot, and the juice of the maple tree, &c. we are indebted for our sugar.

Notwithstanding the studies of the most eminent chemists and naturalists, we do not yet even know how the sugar is formed in these plants. Some make out that in the beetroot, through the medium of the leaves, the carbonic acid from the air is transformed, giving up its carbon, which then enters into direct combination with water or its elements, either for the transformation of the organs of the plant, or for the production of sugar which is formed in the plant. Mr. Dubrunfant thus opposes this objection: If the beetroot was placed so as to find its carbon only in the air, it would be necessary to have it in considerable quantity, because the atmospheric air contains, at most, at the surface of the earth, the constant amount of  $\frac{4}{10,000}$  of carbonic acid. Its results from this hypothesis that the carbon necessary for the production of 100 kils. of sugar would require the aid of a volume of atmospheric air 2,500 times greater—about  $2\frac{1}{2}$  millions of cubic metres—which is inadmissible. But happily, carbon and water do not exist only in the air, in the state of carbonic acid and vapour; they exist as well, and in very great proportions, in the soil, in the state of gas and liquid, according to M. Boussingault. The abundance of this carbonic acid, its normal solubility in water, increased by the presence of the carbonate of lime, greatly contributes, without doubt, to furnish to the beetroot, either directly or by the aid of the roots, the great proportion of carbonic acid required, and this, under the action of the light, which acts powerfully through the leaves, is deprived of its carbon, and at the same time its oxygen is liberated and returned to the atmosphere. This second hypothesis of the production of sugar in the root is confirmed, according to Mr. Blondeau, by the abundant formation in potato of starch, the

chemical composition of which closely approaches that of sugar since it is composed of 44·45 of carbon and 55·55 of water. Besides, it is the most natural supposition that the sugar is formed where it is found in greatest abundance, viz., in the root. Be it as it may regarding these hypothesis, sugar exists in the beetroot, &c., and is got by extracting it from the juice the root contains. M. Vivien then explained the formation and composition of the beetroot, and the different operations the root goes through with this aim. After describing all these operations, the learned professor drew attention to the feeble yield in sugar which the manufacturer gets from the root, even with the most powerful and expensive machinery, and even when combined with all the best processes. In fact, for 100 of sugar which enters the manufactory in the shape of beetroot, only 55 to 60 per cent. is got out. 100! Surely this is an industry opening a vast field for the researches of both the practician and theorist. But this is not all: the beautiful white crystallised sugar produced by the manufacturer is not yet fit for the consumer, or at least only in very small quantities. The taste and custom of the public, relatively happy, to which it appeals, force it to pass through the hands of the refiner, and, when it reaches the consumer, under the form of sugar loaves, broken in pieces, its commercial value, 156 frs. per 100 kilos., for example, is thus made up:—

	Frs.
For the Treasury .....	76
„ Culture .....	38
„ Refining .....	10
„ Commissions, Packing, &c. ....	10
	<hr/>
	134
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So that there remains only 22 frs. for the manufacturer, which must cover all the cost of manufacture. It is known, further, that this part has diminished according as that of the Treasury has augmented, and that this diminution has been made at the expense of the profit of the manufacturer; the improvements carried out on the plant, &c., being more than counterbalanced by the increase in the cost of hand work, coal, and all the other matters employed in the sugar-house.

It may then be said, and with reason, that the history of the tax on sugar is the history of the native sugar industry. Until 1873, beetroot sugar was exempt from taxation. Loaded successively with a tax of 10, 15, and 25 frs. the 100 kilos., it was assimilated to cane sugar as to the duty on consumption, only from the 1st of August, 1847. It is evident that this duty, acting directly on the net cost, caused numerous failures; of 585 manufactories which existed in 1837, there remained only 284 in 1848. The manufacture was maintained only in the parts where the culture was relatively very advanced, hand labour and fuel cheap, as in the department of the Nord, and a part of Pas-de-Calais. And this is the history of every industry founded on a privilege; the redemption of the latter leads to the downfall of the former. But thanks to more perfect machinery, to profitable farming, the manufacture of sugar revived again and even prospered. There remained, for giving it scope, only the assurance of a stable legislation, and, especially, its being placed abroad on the same footing as other industries. This was given by the law of 7th May, 1864. Henceforth, raw sugar might be exported, which could not be done before; and this was, setting aside the faults rightly or wrongly attributed to it, one of the great benefits of that law. From this period new sugar-houses were built every year, and the old ones were enlarged. Thus, whilst in 1863-64, 366 manufactories produced 108,467 tons of sugar, in 1871-72, 494 produced 324,430 tons. Lastly, in 1875-76 the production of 525 factories raised above 450,000 tons. This is the *apogee* of the production, but it is the commencement of the decline. The "*Sucrerie Indigène*" which asked only for its natural development, saw its prosperity checked by the diminution of the consumption. This had amounted in 1870 to 7.5 kilos. per head; to-day, taking into account the loss of Alsace and Lorraine, it is only 6.2 kilos. per head. To what is this diminution attributable? Undoubtedly to the greatness of the duty, which has been increased more than a half since 1872. What has passed in England proves this beyond doubt; there, considerable augmentations have followed each diminution of duty, and to-day, having no duty, the consumption is 81.4 kilos. per head, and tends to increase every

day. This fact is easily understood, as, where sugar is cheap, it is put to a variety of uses unknown in France—preservation of food, manufacture of beer, &c., &c., and enters in some form into the meals of every household of the population. It is thus that in certain countries—Australia, for example—the consumption reaches the enormous figure of 55 kilos. per head. But the evil is still more grave: whilst the production is forced to recede with us, that of the other sugar producing countries increases. In Germany, Austria, and Russia—under the aid, it is true, of a legislation according bounties—the sugar industry is yearly increased, not only to supply the interior demand, but also that of exportation, so that we are forced to disastrous competition in the markets at our doors, that of England especially. To get out of this critical situation—to avoid the ruin, irreparable this time, to the sugar industry, M. Vivien sees only one means—a large reduction on the sugars; that this reduction be spread over a number of years, must be! but it must be large; in this condition the consumer would come to feel its influence. In face of the cultural progress and of the benefits of every kind that manufactured sugar carries with it, it is not only in the name of a suffering industry, but in the name of the general interest, that we again claim the right of this reduction.

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## THE NATIONAL SOCIETY OF QUEENSLAND.

BY AN OLD READER OF *The Sugar Cane*.

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The third Exhibition of this Society, was held on the 19th August and following days, in Bowen Park, Brisbane. The opening displayed the resources of the colony, as well animate as inanimate—organic and inorganic. Gentle ladies were there, as were also the horny-handed sons of toil—in a word, all classes and degrees. The entrance money received on the first day amounted to £609 6s., a sum which indicates the presence of between 11,000 to 12,000 persons who voluntarily taxed themselves to see and enjoy the gratifying collection.

His Excellency the Governor came with Miss Kennedy at noon, attended by the members of the Ministry, and several leading colonists with their ladies, who were received by Mr. A. H. Palmer, M.L.A., as president of the Association, and welcomed with our National Anthem, by the well appointed band of the Volunteer Fire Brigade—riflemen and artillerymen in attendance on duty.

His Excellency, being officially invited to open the business of the day, acceded in a neat and most suitable because short speech, to declare the Exhibition open. We are reminded by such interesting facts as are before us, that our colonies are spread over most of the climates of the globe, and united together by the tie of hearty loyalty and affection for the Mother Country.

The progress of these growing communities is the progress of the Empire, and their increasing wealth and prosperity benefits us all. Everything which gives them a better knowledge of each other's capabilities, and the people at home a better knowledge of them, tends to promote the unity and advancement of the empire. English visitors to the recent Paris Exhibition, learnt something more of their fellow citizens in our colonies, and it has given the colonies themselves, in the words of the Prince of Wales, "an opportunity of becoming better acquainted with each other." Praiseworthy as was that effort of theirs at excellence, yet the effort was not born of the occasion. It is older; it is continuous—expanding day by day, as we shall presently show.

Emigration from England peopled Australia—that great Continent—with men and women of courage and enterprise—none else invited; such attributes found initiatory exercise in the long voyage hence. They were tested when severing the ties of endearment—possibly for ever—and they were matured where idleness suffers neglect, whilst honourable industry, guided by integrity of purpose, continues to receive and enjoy a rich reward. Their sons are hardy, and our home-cricketers acknowledge their prowess. The spirit of emulation is fostered and encouraged in amicable rivalry, including every branch of useful knowledge. Their first task must have been to get food, and the best producer was distinguished as he deserved. Ultimately they meet together by agree-

ment, each bringing a sample of his industry, resolving to do still better, for his own benefit and that of the community. The latter are delighted and the former satisfied with acknowledged excellence on the one hand, and gratifying remuneration for his toil on the other. These efforts result in an annual Exhibition under the banner of the National Association, and substantial prizes await successful competitors.

There is sufficient magnanimity in such a distinctive appellation to bespeak success to the enterprise. It provokes pride in our sons when contemplating that progress which is invited and recorded every year. For example, last year 107 horses were entered for competition, this year 140, not the production of Queensland only, selections of the choicest breeds were sent from Victoria, New South Wales, and other long distances. These horses are the progeny of some of our own noblest and most useful animals, carefully selected and transferred where money is no barrier, but on the contrary an incentive to excellence wherever discovered. The same motive prevailed when selecting nearly every animal shown in Bowen Park, Queensland. The *Queenslander*—a competent authority in these matters—says, “These figures must be looked upon as somewhat surprising in face of the untoward season. In farm and dairy produce and agricultural and horticultural exhibits, the entries exceed the most sanguine anticipation of the Committee.” It will be born in mind that their winter was only then breaking up, and which, if not positive severe, had yet been uncongenial to vegetable growth, being very dry and cold. Their southern neighbours sent agricultural and mining machinery, and the makers of various other useful machinery and furniture freely contributed specimens of their best efforts. In a word, colonial products in every possible variety were sent in profusion. Food was there in multiple variety. The hog, which was cured whole, put in an appearance as an evidence of what can be done in that way, and gold quartz was there in all its tempting wealth and beauty. Schoolboys and school-girls were invited there, and offered prizes for original essays, to be written there and then, in the presence of a sub-committee. For this exercise two hours were apportioned, and the age of the



competitors limited to fifteen years. This voluntary effort for distinction at so early an age gave pleasing promise of future activity and usefulness.

The electric light shone brilliantly, and most appropriately from "The Ladies' Cottage," illuminating the Exhibition building and its approaches.

Torpedoes too were there but in a torpid state and therefore harmless. A fairy fountain generously distributed its refreshing spray on all alike. Singing and conversation was kept up between those in the official building, and others in the Park office, aided by the telephone. The same authority tells us that "Everywhere the eye was gratified or interested with the excellence of the exhibits, and the perfect good taste with which they had been arranged."

With all this luxury of beauty, usefulness and excellence, we are impressed with a hiatus, when viewing the bald accounts of sugar in that sugar-growing district, *e.g.*, "Along the nave, the most noticeable objects were the luxuriant sugar-canes, and the beauteous fern trophies." Again, "we cannot pass over Mr. Hill's samples of sugar which appeared to comprise the produce of nearly every plantation in the colony." We are at liberty to derive consolation, such as it is, from the unpropitious fact, that "A more unfavourable season has rarely been experienced here. A person looking at the exhibits could scarcely suppose that Queensland is suffering from a prolonged and damaging spell of dry weather."

Notwithstanding such adverse circumstances, we find Messrs. Alfred Shaw & Co. erected a small horse-mill and a portable battery to operate on canes grown on the ground of the Board of Enquiry, with the object of showing to visitors how sugar is made. There were also sugar exhibits from Wm. Dart, Coudridge Mills, Brisbane River; Canney Morton, Mary District; Tooth and Cran, Mary District; D. Muir, Coomera, from Helena; White and Robinson, Coomera; and S. and G. Grimes, Brisbane District. The cane exhibits were very fine, and sufficiently comprehensive to be of great value to those who wish to compare the names and qualities of cane grown in different parts of the colony.

From the grounds of the Board of Enquiry, Mr. McPherson had characteristic exhibits, showing the ravages and effects of the

various insects upon the cane, and the cane in its various stages of growth.

As a whole, the sugar exhibits were creditable to the colony, and highly suggestive of the intelligence and skill brought to bear on the cane, its manufactures, diseases, &c.

Perhaps one of the most interesting exhibits was that of Mr. Hill, curator of the Botanic Gardens. It consisted of a neatly-arranged collection of vegetable products used as food. Besides many other articles in daily use, as tea, coffee, pepper, ginger, arrow-root, &c. There were samples, of taro, a very fine flour made from bunya kernels and zamia nuts, and a very good substitute for coffee made from bunya. There was also a sample of dried rosella, six years old, with tinctures and essences, prepared by L. Carmichael, from plants of various odours grown in the Gardens. Mr. Hill also exhibited a collection of native and tropical fruits preserved in glasses. These included the Queensland nut, tamarind, native lime, jack fruit, monster passion fruit, dohl dohl, wampee, wine palm, and an unusually large bunya cone.

The *Queenslander* thus pithily extricates itself from the entanglement of detail where there was so much to admire: "We must not enter into detail. Suffice it to say, that the most encouraging feature of the show was the great number of colonial productions of all sorts and classes."

Without confining our remarks to the National Exhibition, we notice the following by a correspondent of the *Daily News*, which must be gratifying to our colonial friends:—"In the South Australian Court the visitors were received by Mr. Joshua Boothby, Under Secretary of State for that colony and Executive Commissioner. He presented Madame MacMahon with a muff, the fellow to one made out of Australian ostrich feathers for the Princess of Wales. The rugs of Angora goatskin elicited expressions of warm admiration. They were sent from Adelaide, taken from goats of Asiatic ancestry, bred by Mr. Maurice Price, and are of a most extraordinary beauty. South Australia's agricultural and mineral exhibits have won a rich harvest of prizes. Its wool has carried off the gold medal, and that of New South Wales the *Grand*

*Prix.* Attention was called to an immense block of malachite taken from the Burra Mine. Russia has sent nothing so fine. South Australia is very proud of its manufactured silver ware. A racing cup in sterling gold by Wends, and an épergne are the most remarkable of these exhibits. The latter represents a gum tree, around which are grouped subjects in high relief taken from the bush, the sheep-run, the diggings, the mines, and the vineyard. This work of art will be presented by the colony to Sir Philip Cunliffe Owen as a testimonial of the services rendered by him, and is valued at £250. The Hon. Edward Combes and M. Jules Joubert took the visitors through the New South Wales Court, about the mineral wealth of which the former gave some explanations. There were opals and other precious stones to which the attention of the ladies in the Presidential party were drawn. The views of Sydney Harbour attracted Madame MacMahon's attention. In the Victoria Court, about the marvellous agricultural and mineral exhibits in which I have previously spoken, the visitors were received by Mr. Collins Levey, who speaks French like a Frenchman."

To conclude we add from the *Gazette* :—

"The Queen has been graciously pleased to make the following promotion in, and appointments to, the Order of St. Michael and St. George for services rendered to the Colonies as Colonial Commissioners and otherwise in connection with the representation of British colonial products at the Paris Universal Exhibition of 1878 :—To be an Ordinary Member of the First Class, or Knights Grand Cross of the Order : Sir John Rose, Bart., K.C.M.G., Executive Commissioner for the Dominion of Canada, and Member of the Finance Committee. To be an Ordinary Member of the Second Class, or Knights Commanders of the said order : Francis Philip Cunliffe Owen, Esq., C.B., Secretary to the British Commissioners. To be Ordinary Members of the Third Class, or Companions of the said order : Charles Alphonse Pantaléon Pelletier, Esq., President of the Executive Committee for the Dominion of Canada, and late Minister of Agriculture and Statistics, and Commissioner of Patents for the Dominion ; Edward Combes, Esq., Executive Commissioner

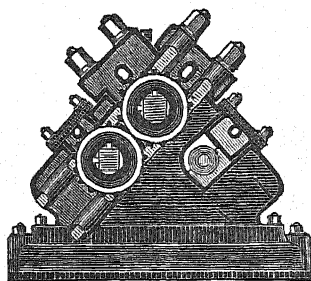
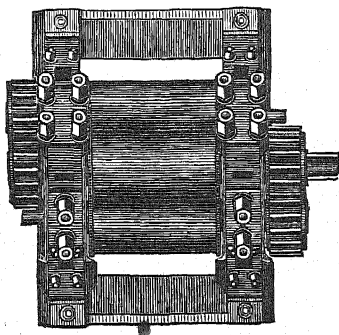
for the colony of New South Wales; James Joseph Casey, Esq., President of the Victoria Commission, Executive Commissioner at Paris for the Colony of Victoria; Thomas Coltrin Keefer, Esq., C.E., Executive Commissioner for the Dominion of Canada; Josiah Boothby, Esq., Permanent Under Secretary South Australia, Executive Commissioner for the Colony of South Australia; John Spencer Bridges Tod, Esq., Executive Commissioner for the Colony of the Cape of Good Hope; Arthur Hodgson, Esq., Executive Commissioner for the Colony of Queensland; George Collins Levey, Esq., Secretary to the Victoria Commission and Acting Commissioner in charge of Victorian Exhibits."

### Correspondence.

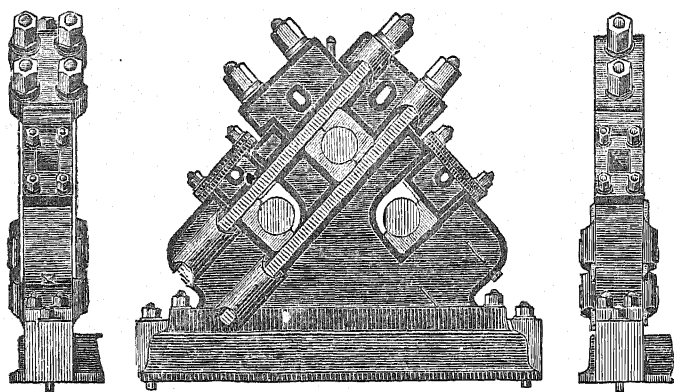
#### ROBERT BARTLETT'S PATENT SUGAR-CANE CRUSHING MILL.

TO THE EDITOR OF "THE SUGAR CANE."

SIR,—With your permission, I now submit to your readers the following description of my new patented Crushing Mill:—



It will be seen by the above arrangement, viz., having two caps instead of the solid jaw to form the upper part of the mill cheek, I am enabled to so place the brasses that the wearing surface and seats are brought directly opposite to the heaviest pressures or strains; the seats of the brasses being at right angles, with the bolts bearing the heaviest pressures and strains.



The above arrangement enables me to put the greatest number of main bolts on both sides, and in a line with the centres of the top and megass rollers; between which bolts the heaviest strain is concentrated. By using, as I do, eight bolts on this side of the mill, I bring the pressure closer up to the rollers, thereby preventing the camber or spring of the gudgeons, caused by the pinching screws being placed over the centre of the width of the journals, and which is generally the cause of the keys which attach the rollers to the gudgeons being loosened.

I place four main bolts—two on each side of each journal—thus easing the lesser strain between the top and cane roller, and thereby doing away with the side pinching screws altogether. These screws I have always found to give much trouble; they invariably strip the threads, or stave up at the ends, which eventually means blocking the lower brasses against the cheek.

Thus it will be seen that I get over the greatest defect in the ordinary mills, which experience has proved to me is, screwing up the lower rollers in a horizontal direction, and screwing down the top brasses or bearings in a vertical direction. The strain or pressure is always so much greater between the top and megass roller than between the top and cane roller, that the journal of the

We profess ourselves incompetent to form an opinion on the merits which Mr. Bartlett claims for his new Mill. Our readers will exercise their own judgment thereon.—*Ed. S. C.*

top roller is forced into the opening between the old vertical bearings; and wearing only on the side of the top brass nearest to the feeding or cane side of the mill, causes it to become heated, and cuts itself away; eventually breaking the cheek on that side, or necessitating its being slackened to cool down; which I need not add in either case means a great loss. In doing this I dispense with the large amount of metal coming between the gudgeons of the rollers, which, in mills as ordinarily constructed is necessary to form the jaw for the top journal, and bear the unequal strain put upon it by the megass roller; and which, as before mentioned, invariably gets broken and renders the cheek useless. I need not add that a broken cheek is fatal to a crop: engineers, &c., being generally pressed with work during crop seasons, a very inefficient means of clamping and patching is resorted to, which is always considered to be very cleverly done, and strong, and no doubt is the best that can be done under the circumstances; but which at best means a loss of 10%, if not more, upon the already deficient squeezing. Even in cases where a spare cheek is at hand, it causes an enormous loss of time to put it in place; and the spare cheek gets hurried in, not always properly adjusted or fitted, leading afterwards to many mishaps, and in the end sharing the same fate as its predecessor.

Thus, by keeping the framing of the mill intact and perfectly safe from fracture, any other part can be replaced by the staff on the estates generally entrusted with the machinery.

This mill is calculated to give the very best paying result from any kind of canes; and will squeeze in a superior manner to ordinary mills, the very oldest ratoons, with less power and less risk of breakage. Should any slight change in the setting of the rollers be required, it can easily be effected by the slightest movement of the nuts on the main bolts; one tenth part of a turn making 10% difference in heavy squeezing. Should it be necessary to pass a large amount of canes through the mill, even at a loss, in order to do an excess of work, the set is changed by removing a solid plate from beneath the lower roller bearings, in proportion to the work to be done. Thus it will be seen that the only risk is, the fracture of one or two of the main bolts, which would be the very worst calamity

that could happen, and these are parts that can always be repaired equal to their original strength at a small cost. As these bolts are calculated to break first, at the key or cotter end, the most expensive part is retained intact; and bolts of this kind are the most easily replaced with regard to time. Thus, I prevent the great difficulty which so often occurs to the planter, whereby he is obliged to sacrifice a great part of his crop; because if he tightens up his mill, he breaks it beyond substantial repair for one crop at least, and the repairs are a heavy item on the next.

The loss during repairs is also very great, the canes that are cut for grinding losing about  $1\frac{1}{2}\%$  of saccharine juice every twelve hours they lie on the ground, and the remaining juice meanwhile forming glucose, gives a much lower yield of sugar. Consequently, in many cases, wages, &c., have to be paid simply to grind, and boil into molasses or rum; whereas one of these main bolts can be replaced in one hour at the outside in a mill weighing one hundred tons.

It will be seen that, if necessary, the lower rollers can, as in most modern mills, be taken out without removing the top one.

By keeping the main bolts in a line with the centres of each pair of rollers, (the top one being common to both lower ones) and doing away with the metal usually necessary between the gudgeons of rollers, I bring the two lower rollers closer together, and considerably reduce the width of the dumb returner; which width in large mills is becoming somewhat troublesome. I also give the returner a substantial fixing, and an arrangement of adjusting that is easily accessible; the arrangements in other mills being in my opinion inefficient, and as experience has proved, quite inadequate for squeezing at high per centages.

I arrange all the journals or gudgeons of the same size, for it is necessary that the megass roller should be capable of bearing the same strain as the top one. The principal work is between these two, and, if the gudgeon is weaker, the roller is most likely to be drawn off its keys, and loosened, if not split, and very probably the gudgeon broken.

Although the work of the front roller is very small compared with

the others, it is not policy to reduce its gudgeon or journals ; as by keeping it the same size, one spare roller can be arranged to take the place of either of the three.

I also remedy a constant and very troublesome evil connected with sugar mills, *i.e.*, the frequent breakage of pinions. It seems to have been the idea of most makers that the mills work with the rollers equidistant from each other, and that the same size pinions are near enough for both sides. This is a fallacy ; and one which has become more prominent of late, since it has been proved to be necessary to keep the cane roller much wider open than in former times, in order to get a better result or percentage of juice from the cane. It is a mistake to do too much work with the cane roller, provided of course that the mill is strong enough to do its work properly with the back one, and it is only necessary to break up the cane with the front or cane roller, that it may feed the second or megass roller properly. It will be found quite unnecessary to add steam or water to get the best result, for I contend that there is quite water enough in cane juice itself to bring all the sugar out, with a proper mill and plenty of power applied to it.

The necessary difference between the rollers being so great, I arrange two pinions on the top roller gudgeon, of different sizes, and also one on each of the lower or side rollers to pair with them ; so that each pair can be properly geared and wear together. In the event of fracture from accident, only two of these at most can be broken instead of three, as is generally the case. This arrangement also prevents the enormous wear, caused by the front pinion only reaching just to the tips of the teeth of the top pinion, and wearing them off rapidly ; and the same top pinion wearing unevenly into the megass pinion, destroys it as well, thereby causing the whole to be removed or broken before they have been fairly worn. By having the pinions properly geared and paired, they will last longer, wear more evenly, and in porportion to each other, retaining both their shape and strength for a much longer period.

Thus I am enabled to offer a mill simple and strong, without any weak points likely to break or get out of order, and capable of bearing much heavier pressures and strains than ordinary mills,



thereby rendering it quite safe to apply much more engine power than has been the usual practice.

My reason for introducing this class of mill is, I am convinced after a long practical experience that cane mills as usually made are neither strong enough or of proper design. Nor have we been in the habit of applying sufficient power to them to do justice to the planter and his canes. Of the loss occasioned by bad squeezing I need not speak ; that is well known to most planters and mill owners. It is sufficient to say, that I offer a mill capable of withstanding all the power necessary to be applied, to do the very best of work, and give more profitable results than can possibly be obtained by mills as at present constructed.

Having a strong and safe mill, we now have to look for the means of obtaining the power. In sugar works that have really good and powerful engines, with all their steam connections for defecation, &c., complete, I propose to change only the gearing, and the velocities of the engines where possible ; for it is evident we must not go on increasing the size of the high pressure engines any further, or add to their number, as the fuel obtained from the cane is already barely sufficient, and with better squeezing it will be less. Therefore in erecting new plants, I should recommend the " compound engine," in order that the large high pressure cylinders now in use may be superseded by smaller ones, taking much less steam, fewer boilers, and less fuel. At the same time, with the compounded or low pressure cylinder added, the power will be increased 10%. For instance, while an engine with cylinder 25 inches diameter by 5 feet stroke would give 172 horse power, a compound engine with high pressure cylinder 17 inches diameter by 4 feet stroke, or just half the capacity for using steam, would give 192 horse power. Or, if we put a cylinder 19½ inches diameter by 4 feet stroke, which ordinary estates' boilers would supply, we shall get 240 horse power ; and so on in proportion.

In arranging new or re-arranging old works, I put a condenser for the low pressure cylinder of the compound engine close to the mill, and use the cane juice for condensing the steam, thereby raising the temperature of the cane juice as quickly as possible after it is

expressed. This will utilize the steam for power, and the juice will absorb the heat direct, dispensing with the large pipes and valves for back-pressure steam throughout the buildings, and considerably simplifying the fittings. The cane juice, I need not add, is well suited for condensing purposes, as it generally leaves the mill from 6 to 8 degrees below the ordinary temperature of the tropical atmosphere.

With such machinery we can certainly realize at least 10% more juice from the cane than with mills as at present made; and I feel confident of obtaining a still better result. Few mills average for the whole crop more than 60 to 61% of juice, and the more modern and best of mills from 63 to 64%. I am certainly underrating the capabilities of my mills when I state only a 10% better result.

We gain at least by the extra squeezing from every 100 tons of canes, 10 tons of juice; which juice (at 10° Beaumé), taking the yield at 1600 gallons per ton that is to say, only 1.40 lbs. per gallon, gives 1.32 tons of sugar.

Thus 100 tons of canes at 60% gives  $1.32 \times 6 = 7.92$  tons sugar  
And 100    "        "        70%    "     $1.32 \times 7 = 9.24$         "

Of course we have the molasses and rum in addition, except in cases of making concrete, when from there being no molasses or rum the yield of produce would be much higher. Taking the increased return of sugar, we gain 1.32 tons on 7.92 tons, or 16.66%. And thus an estate making 1000 tons of sugar, gives an additional 166.60 tons more sugar from the same canes; which at say £22 per ton, less £12 the cost of producing, gives an additional profit of £1,666 on the crop; which would more than pay for one of these mills in two crops.

The profits will really be more than the above figures seem to indicate, for the extra sugar being obtained from the same canes as the lesser quantity, involves no extra cost for growing.

With regard to the engines I propose to use, it is clear that they not only pay for themselves, but realise a profit, by the saving effected in boilers and fuel.

### RUSSIAN DRAWBACKS.

By a mandate of the Russian Government, the exportation drawback on native sugars, for the period between the 1st of October, 1878, and the 28th of April, 1879, has been reduced as follows :—

1st.—White refined and grain sugars, the *poud*, 65 *copecks*, (15·87 frs. the 100 kilos.), instead of 80 *copecks* (17·52 frs. the 100 kilos.)

2nd.—Sugars of medium quality, and of a colour between white and yellow, the *poud*, 55 *copecks*, (13·43 frs. the 100 kilos.), instead of 75 *copecks* (10·69 frs. the 100 kilos.)

3rd.—Moist sugars, the *poud*, 35 *copecks*, (8·55 frs. the 100 kilos.), instead of 45 *copecks* (10·69 frs. the 100 kilos.)

### MONTHLY LIST OF PATENTS.

Communicated by GEORGE DAVIES, C.E., Patent Agent, 4, St. Ann's Square, Manchester.

#### ENGLISH.

##### APPLICATIONS.

4376. ALEXANDER SCOTT, jun., of Greenock, North Britain, Sugar Refiner, and ANDREW McDONALD, of Glasgow, North Britain, Manufacturing Chemist. *Improvements in treating and utilizing residual liquors obtained in manufacturing or refining sugar.*

4586. HERBERT JOHN HADDAN, of 67, Strand, Westminster, Civil Engineer. *Improvements in the defecation, decolourization, and refining of saccharine liquids.* (A communication to him from Jacob William Decastro, of New York, United States of America.)

4676. CHARLES DENTON ABEL, of Southampton Buildings, Middlesex. *Improvements in centrifugal machines for separating substances from each other.* (A communication from Eugen Langen, of Cologne, Germany.)

##### ABRIDGEMENTS.

901. ALEXANDER BROWNE, of 5, Southampton Buildings, Middlesex. *Improvements in filter-presses.* (A communication from George Bourdon, of Paris, France.) The chief characteristics of this invention are as follows :—The filter frames are suspended by brackets and rollers, which run on rails or bars, and a follower also suspended by brackets and rollers; and running

on these bars is actuated by a fly-wheel and screw or screws, which tighten the filter frames together or release them as required. The weight of each filter frame is such as to prevent its rollers from slipping on the rails. The spindles connecting each pair of rollers and brackets are squared at one end, which fits in a handle, by means of which the frames may be detached from each other. The frames are provided at the top with a central hole, furnished on one side with a small conical tube, and on the other with a corresponding recess, which enables them to fit closely to each other. Thus, by means of steam or water connection to the first frame, the fluid is made to percolate through all, entering the grooves and passing behind the cloths or mats, and cleaning them completely. The ordinary outlet tap is replaced by a valve with screw spindle, having cone point, with a passage horizontally through, closed outside by a screw plug, and the frame pierced throughout its width by a hole, the other end of which is closed by a screw stopper. By unscrewing this latter, and the screw plug in front of the plug in front of the valve, a rod may, when required, be introduced for cleaning; this also allows the outlet cock to be placed at either side of the filter-press. A ratchet and lever is employed to give the final pressure on the frames when the fly has brought them close together. An arrangement is made for the construction of a vertical press, in order to get the press cakes out entire. The filter cloths are made of amianth, wire gauze, and other alkaline liquid resisting substances. The central joint rings on the cloth are dispensed with, and small cloth sleeves are sewn in between the filter frames, thus quite closing the central opening. A process is also described for separating the press cakes, and for collecting the liquid expressed; also a mode of forming joints for the frames, and for heating the same, when required. A means of indicating the pressure employed, and a method for producing a systematic or repeated filtration in one filter-press for liquids difficult to filter, also form part of the invention.

1298. EUSTACE CAREY PRENTICE, of Stowmarket, Suffolk. *Improvements in filter presses.* This filter press consists of rings or frames separated by channelled partitions lined on both sides by filtering fabric, which partitions extend to the exterior of the rings or frames so as to allow of the escape of the filtered liquid. These rings or frames and their partitions are held together between two strong end covers by means of bolts or other pressure. The compartments thus formed may be supplied by separate pipes or they may communicate by holes cut through the partitions, the filtering material on either side being then tightly fastened together so that no liquid can reach the channelled partitions except through the pores of the filtering fabric.

(The following invention received Provision Protection only.)

1123. HENRY RAWLINGS, of 108, St. Martin's Lane, Westminster, Filter

**Manufacturer. Improvements in filter presses.** In this arrangement, the filtering chamber is distinct from, though intimately connected with, that in which the substance is compressed, and preferably above the same. The filtering apparatus consists of a perforated tube or pipe on which are arranged alternately discs of metal or other convenient material, and discs of suitable filtering materials, these latter being slightly larger in diameter than the metal or other plates or discs. The holes in these discs are such that they can easily move on the central tube or pipe, and the discs are compressed together when placed in the filtering chamber, the fluid from the compressing chamber finds its way through pipes or otherwise to the filtering chamber, where it percolates through the filtering discs into the central pipe.

## AUSTRIAN.

38. F. HADRAVA, of Skalitz. *A beetroot cutter.*

## BELGIAN.

46,253. E. A. J. CHARLES, of Brussels. *A system of diffusion applicable for the manufacture of beet sugar.*

## FRENCH.

123,361. SEYFERTH.—*Apparatus for extracting sugar by lixiviating the molasses with alcohol.*

128,813. SEYFERTH.—*An apparatus for refining and moulding sugar in one operation.*

123,913. WHITE.—*Improvements in the method of and in the apparatus for continuously evaporating cane and other saccharine juices, solutions of salt, and other liquids increasing in density by evaporation.*

124,080. ZÉNISEK and SCHMIDT.—*A process for extracting sugar from the residues of sugar works.*

## SUGAR STATISTICS—GREAT BRITAIN.

To Nov. 16TH, 1878 AND 1877. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

	STOCKS.		IMPORTS.		DELIVERIES.	
	1878.	1877.	1878.	1877.	1878.	1877.
London . . . .	49	89	224	269	270	238
Liverpool ..	22	26	170	179	180	170
Bristol . . . .	1	2	39	38	40	40
Clyde . . . . .	36	36	218	230	222	212
Total ..	108	153	651	716	712	660
Decrease..	45		Decrease..	65	Increase..	52

STOCKS OF SUGAR IN THE CHIEF MARKETS OF THE WORLD ON THE  
1ST OCTOBER, FOR THREE YEARS, IN THOUSANDS OF  
TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
155	43	15	16	3	232	221	225

CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING  
1ST OCTOBER, IN THOUSANDS OF TONS.

Great Britain.	France.	Holland	Germany (Zollverein)	Five other entrepôts.	TOTAL 1878.	TOTAL 1877.	TOTAL 1876.
925	272	24	292	194	1707	1535	1652

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE,  
FOR THE ENSUING SEASON, COMPARED WITH THAT OF THE THREE  
PREVIOUS SEASONS.

(From Licht's Monthly Circular.)

	1878-79.	1877-78.	1876-77.	1875-76.
	Tons.	Tons.	Tons.	Tons.
France .....	380,000 ..	398,132 ..	243,295 ..	462,259
Germany (Zollverein) ..	385,000 ..	383,828 ..	291,204 ..	346,646
Austro-Hungary ....	335,000 ..	330,792 ..	247,175 ..	208,912
Russia and Poland ..	215,000 ..	220,000 ..	250,000 ..	245,000
Belgium .....	65,000 ..	63,075 ..	44,467 ..	79,796
Holland and other Countries.....	30,000 ..	25,000 ..	25,000 ..	30,000
Total.....	<u>1,410,000</u>	<u>1,420,827</u>	<u>1,101,141</u>	<u>1,372,613</u>

## STATE AND PROSPECTS OF THE SUGAR MARKET.

During the past month useful kinds of refining cane sugars have given way about 6d. Beetroot sugar has regained a little in price during the month, buyers, however, being very cautious purchasers at any advance.

Austrian 88 per cent., is quoted 20s. 3d.; Belgian 88 per cent., 20s. 9d.; German 88 per cent., 20s. 3d.; and 96 polarization, 20s. 3d.

The stock of sugar in the United Kingdom has decreased still further, as compared with the stock at the same periods in 1877, from 14,000 on the 19th October to 45,000 on the 16th November, 1878.

The consumption for the year, on 28th September last, was about 50,000 in excess of that of 1877; whilst on the 16th November it stood at about 52,000 tons in excess of the consumption of 1877 at that date.

Paris loaves are about 6d. cheaper during the month.

On the whole, lower prices do not appear to be called for, though with such a disturbing element in the market as French bounties, any reliable prognostication is impracticable.

The market closes with a quiet tone.

Present quotations of the standard qualities are as under:—  
Porto-Rico fair to good refining, 21s. to 21s. 6d., against 21s. to 21s. 6d.; good to fine grocery, 22s. 6d. to 24s. 6d., against 22s. 6d. to 24s. 6d.; Martinique crystals, 25s. 6d. to 26s. 6d., against 25s. to 26s.; No. 12 Havana, 22s. 6d. to 23s., against 23s. to 23s. 6d.; fair to good refining Cuba Muscovados, 21s. to 21s. 6d., against 21s. 6d. to 22s.; middling to good brown Bahia, 18s. to 18s. 6d., against 18s. 6d. to 19s.; good to fine Pernambuco, 18s. 6d. to 19s. 6d., against 19s. to 20s.; Paris loaves, 26s. 6d. to 27s. 6d., against 27s. to 27s. 9d.







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Return Date	Return Date